CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

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Introduction

This chapter examines how herbicide treatment activities that utilize the three new active ingredients (aminopyralid, fluroxypyr, and rimsulfuron) may affect natural, cultural, and socioeconomic resources on public lands. The focus of the analysis is on the impacts associated with application of herbicide formulations that include the three active ingredients, and on the alternative proposals for use of these herbicides. These herbicides would be part of a larger vegetation management program, and would potentially be used in conjunction with other treatment methods and other currently approved herbicides. A summary of impacts associated with the use of the 18 currently approved herbicides and with other treatment methods can be found in the *Vegetation Treatments on Bureau of Land Management Lands in 17 Western States PEIS* (USDOI BLM 2007a) and *Vegetation Treatments on Bureau of Land Management Lands in 17 Western States PER* (USDOI BLM 2007c).

How the Effects of the Alternatives Were Estimated

Within each resource area, applicable direct and indirect effects are evaluated. Cumulative effects, unavoidable adverse effects, and resource commitments that are lost or cannot be reversed are identified in this PEIS. These impacts are defined as follows:

- Direct effects – Effects that are caused by the action and occur at the same time and in the same general location as the action.

- Indirect effects – Effects that occur at a different time or in a different location than the action to which the effects are related.

- Cumulative effects – Effects that result from the incremental impact of the action when it is added to other past, present, and reasonably foreseeable future actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time. For this PEIS, potential cumulative effects include those that could occur on other federal and non-federal lands. Cumulative effects also consider other types of vegetation treatments and treatments with other herbicides.

- Unavoidable adverse commitments – Effects that could occur as a result of implementing any of the action alternatives. Some of these effects would be short-term, while others would be long-term.

- Irreversible commitments – Commitments that cannot be reversed, except perhaps in the extreme long term. This term applies primarily to the effects of use of nonrenewable resources, such as minerals or cultural resources, or to factors, such as soil productivity, that are renewable only over long periods of time.

- Irretrievable commitments – Commitments that are lost for a period of time. For example, timber production is lost while an area is mined. The production lost is irretrievable, but the action is reversible. If the site is reclaimed, it is possible to resume timber production.

In addition, this PEIS considers the interaction of effects, as follows:

- Additive – total loss of resources from more than one incident.

- Countervailing – negative effects are compensated for by beneficial effects.

- Synergistic – the total effect is greater than the sum of the effects taken independently.

This chapter should be read together with Chapter 2 (Alternatives), which explains the alternative proposals that the BLM is considering for use of the three new herbicide active ingredients for treating vegetation, and Chapter 3 (Affected Environment), which describes the important resources and their occurrence and status on public lands. The analyses of environmental consequences in this chapter build upon and relate to information presented in these earlier chapters to identify which resources may be impacted and how and where impacts might occur.

Assumptions for Analysis

This analysis addresses large, regional-scale trends and issues that require integrated management across broad landscapes. It also addresses regional-scale trends and changes in the social and economic needs of people. This analysis does not identify site-specific effects because its focus is on broad-scale management direction. As discussed in Chapter 1, Proposed Action and Purpose and Need, site-specific issues would be addressed through environmental analyses prepared at the state, district, or field office level.

At the local level, the Ecosystem-Based Management approach would be used during development of site-specific management goals to ensure that they are informed and adapted from learning based on science and local knowledge.

The assumptions about vegetation treatments that were made in the 2007 PEIS (USDOI BLM 2007a:4-1 to 4-2) carry over in this PEIS, as the new herbicides would be integrated into current treatment programs.

Vegetation treatments are implemented with consideration for the larger land management context in which they occur. The BLM considers whether and how treatment areas will be revegetated or stabilized to ensure the long-term viability of the project area. The BLM strives to minimize long-term increases in bare ground resulting from vegetation treatments, which might allow invasive plants to increase in abundance. Treated vegetation is removed from the site if it poses a further risk as hazardous fuel.

The impacts analysis assumes the following:

- Vegetation treatments would be developed and applied in an Integrated Pest Management context, where all treatment methods, costs, and goals are considered.
- Tool(s) identified for the treatment would be the appropriate means to achieve the project objective.
- Post-treatment follow-up such as seeding, monitoring, and retreatment would occur, as needed to achieve land management objectives.
- Maintenance of past treatments has occurred, and the BLM would maintain improved vegetation conditions, rather than implementing stand-alone, one-time treatments.
- The BLM would determine the need for the action based on inventory data and monitoring. Post-treatment monitoring would occur after the project to ascertain its effectiveness in achieving the resource objective(s).
- The BLM would comply with federal, state, tribal, and local regulations that govern activities on public lands.
- The BLM would continue to follow SOPs and applicable mitigation listed in the 2007 PEIS (USDOI BLM 2007a:Table 2-8) and ROD (USDOI BLM 2007b:Table 2) under all alternatives to ensure that risks to human health and the environment would be kept to a minimum.

Examples of SOPs that pertain to all resource areas include the following:

- Conduct a pre-treatment survey for sensitive resources.
- Identify the most appropriate treatment method. If chemicals are the appropriate treatment, then select the chemical that is least damaging to the environment while providing the desired results.
- Consider surrounding land uses before selecting aerial spraying as a treatment method.
- Apply the least amount of herbicide needed to achieve the desired results.
- Prepare a spill contingency plan in advance of treatment.
- Notify adjacent landowners prior to treatment.
- Require licensed applicators to apply herbicides.
- Use only USEPA-approved herbicides, and follow product label directions and “advisory” statements.

- Follow the product label for use and storage.
- Review, understand, and conform to the "Environmental Hazards" section on the herbicide label. This section warns of known pesticide risks to the environment and provides practical ways to avoid harm to organisms or the environment.
- Avoid accidental direct spray and spill conditions to minimize risks to resources.
- Avoid aerial spraying during periods of adverse weather conditions.
- Make helicopter applications at a target airspeed of 40 to 50 miles per hour (mph), and at about 30 to 45 feet above ground.
- Keep a copy of Safety Data Sheets (SDSs)/ Material Safety Data Sheets (MSDSs)[1] at work sites.
- Keep records of each application.
- Implement additional applicable SOPs specific to individual resources, which are provided in the impact analysis section for each resource.

Additionally, mitigation measures specific to treatments with the three new herbicides have been identified for certain resource areas in Chapter 4. These mitigation measures could further reduce impacts associated with herbicide treatments.

Incomplete and Unavailable Information

According to the Council on Environmental Quality regulations for implementing the procedural provisions of NEPA (40 CFR 1502.22), if the information is essential to a reasoned choice among alternatives and the cost of gathering it is not excessive, it must be included or addressed in the PEIS.

Generally, the types of incomplete and unavailable information are the same as those described in the 2007 PEIS (USDOI BLM 2007a:4-3 to 4-4). Although knowledge about many aspects of terrestrial and aquatic species, forestland, rangelands, the economy, and society is still incomplete, the alternatives were evaluated using the best available information.

Ecological and human health risk assessments were developed by the BLM for aminopyralid, fluroxypyr, and rimsulfuron to address many of the risks that would be faced by humans, plants, and animals, including special status species, from the use of these three active ingredients. To assess risks to other resources from the use of herbicides, the BLM consulted information in the risk assessments and supporting documentation; state, federal, and local databases, Geographic Information System (GIS) data, and contract reports; subject experts within and outside of the BLM; and the current literature.

A programmatic analysis over a 17-state area generally summarizes information that may be available at finer scales (e.g. at the regional and local level), but is too de-centralized and dispersed to be presented effectively. In these cases such information will be presented during analysis at the local level to make more informed decisions about specific treatment projects involving aminopyralid, fluroxypyr, and rimsulfuron.

While additional information may add precision to estimates or better specify relationships, new or additional information is unlikely to significantly change the understanding of the relationships that form the basis of the effects analysis presented in this chapter.

Subsequent Analysis before Projects

Before site-specific actions are implemented and an irreversible commitment of resources is made, information essential to fine-scale decisions will be obtained by the local land managers. Localized data and information will be used to supplement or refine regional-level data and identify methods and procedures best suited to local conditions in order to achieve the objectives in this PEIS. Further analysis would be necessary to deal with site-specific conditions and processes. For example, mitigation measures identified in the following sections (and in the 2007 PEIS) would be appropriate for protecting resources under the wide range of conditions that must be considered at the programmatic level of analysis. However, by considering more site-specific parameters, such as soil and vegetation type and amount of rainfall, the BLM may be able to use less restrictive mitigation measures

[1] Hazardous chemical reporting is now required to be done via an SDS, rather than the previously used MSDS. During the period of transition to the new reporting system, herbicides may have either an associated MSDS or SDS.

and still ensure adequate protection of the resource. It is also possible that more restrictive measures would be necessary. This subsequent analysis will be used to bridge the gap between broad-scale direction and site-specific decisions. This "step-down" analysis involves subsequent NEPA analysis at various levels, which may include the regional or statewide level, the district or field office level, and the local or project-specific level (USDOI BLM 2007a:1-19).

Program Goals by Ecoregion

The goals of herbicide treatments were developed for the 2007 PEIS, and are presented by ecoregion in the following sections. These goals continue to represent what the BLM hopes to achieve through the use of vegetation treatments on public lands, and are being carried forward in this PEIS. Herbicide treatments with the three new herbicides would be incorporated into the larger treatment program designed to meet these goals.

Temperate Desert Ecoregion

Over 70 percent of herbicide treatments would occur on BLM land in the Temperate Desert Ecoregion. Most of these treatments would be used to meet vegetation and integrated weed management (IWM) objectives (as outlined in BLM Manual 9015 [USDOI BLM 1992]; 33 percent of treatments), reduce hazardous fuels (25 percent), conduct emergency stabilization and burned area rehabilitation activities (19 percent), and improve rangeland health (12 percent). Improvements of wildlife habitat and watershed health are objectives of lesser importance (6 and 5 percent of treatments, respectively) in this ecoregion.

Temperate Steppe Ecoregion

In the Temperate Steppe Ecoregion, most herbicide treatments would be conducted to meet integrated vegetation management (IVM) and/or IWM objectives (62 percent of treatments). Other important objectives include hazardous fuels reduction (25 percent) and improvement of rangeland health (11 percent).

Subtropical Steppe Ecoregion

On BLM lands in the Subtropical Steppe Ecoregion, herbicide treatments would be used to improve habitat (38 percent of treatments), improve rangeland health (21 percent), reduce hazardous fuels (17 percent), and meet IVM and/or IWM objectives (11 percent).

Mediterranean Ecoregion

In the Mediterranean Ecoregion, chemical treatments would be conducted primarily to improve forest health (35 percent of treatments), and to meet maintenance-related (28 percent) and IVM and/or IWM (20 percent) objectives. Improvement of rangeland health (9 percent) and recreation areas (6 percent) would also be important objectives.

Marine Ecoregion

On BLM lands in the Marine Ecoregion, the majority of herbicide treatments would be conducted to meet IVM and/or IWM (69 percent) and maintenance-related (22 percent) objectives. Some less important treatment objectives include maintaining ROWs (3 percent), improving forest health (3 percent), and improving habitat for native vegetation (3 percent).

Subtropical Desert Ecoregion

Less than 1 percent of herbicide treatments would occur on BLM land in the Subtropical Desert Ecoregion. Herbicide treatments in this ecoregion would focus on managing woody species that have invaded shortgrass and mixed-grass prairies and riparian areas of the desert Southwest.

Tundra and Subarctic Ecoregions

Herbicide treatments in this ecoregion would occur on a very small portion of public lands in these ecoregions. It is estimated that no more than 1,000 acres of public lands in Alaska would be treated with herbicides in any year. Goals of future herbicide treatments in these ecoregions would be to control invasive species in disturbed areas (along trails and roads, and at heavy use areas) to prevent their spread into more pristine areas.

Land Use

Laws, regulations, and plans that pertain to land use are summarized in the 2007 PEIS (BLM 2007a:4-5). The FLPMA of 1976 directs the BLM to manage public lands to protect their resource values, and to develop resource management plans consistent with those of state and local governments. Management actions on public lands are guided by land use plans, which establish goals and objectives for resource management.

Similar to the 2007 PEIS, this PEIS is a national-level programmatic analysis. It contains broad regional descriptions of resources, provides a broad environmental impact analysis, and provides Bureau-wide decisions on herbicide use for vegetation management. Additionally, it provides an umbrella ESA Section 7 consultation for the broad range of activities described in the PEIS.

Impacts to land uses have not been identified at the programmatic level. It is assumed that vegetation treatments by all methods would continue to occur on up to 6 million acres annually, that treatments would continue to focus on areas with high levels of hazardous fuels and invasive plants, that land uses would comply with the intent of Congress as stated in the FLPMA (43 U.S.C. 1701 et seq.), and that future land uses would be similar to those that currently occur on public lands.

Adding new active ingredients to the BLM's list of approved herbicides would be expected to have a minimal effect on land uses. Herbicide treatments would continue to be conducted over the same geographic area and with the same program goals, and so would have no additional effects. However, it is assumed that under all alternatives, existing land use plans will be updated to include additions to the approved herbicide list, with modifications occurring primarily at the field office level.

Air Quality and Climate

Air quality is the measure of the atmospheric concentration of defined pollutants in a specific area. Air quality is affected by pollutant emission sources, as well as the movement of pollutants in the air via wind and other weather patterns. This air quality analysis focuses on the release of criteria pollutants and GHGs associated with herbicide treatments.

Scoping Comments and Other Issues Evaluated in the Assessment

Scoping comments requested that this PEIS quantify GHG emissions from the proposed project activities.

Emission Sources and Impact Assessment Methodology

The potential impacts of herbicide use on air quality originate primarily from ground vehicle (truck, ATV/UTV, and boat) and aircraft (plane and helicopter) emissions, as well as fugitive dust (dust created by vehicle travel on unpaved roads) resulting from herbicide transport and application. In addition, spray drift (movement of herbicide in the air to unintended locations) and volatilization (the evaporation of liquid to gas) of applied herbicides temporarily results in herbicide particles in the air, which can be inhaled and deposited on skin or plant surfaces and affect humans, wildlife, and non-target plants. Herbicide particles can be transported away from the target location, depending on weather conditions and the herbicide application method.

Methodology for Assessing Impacts to Air Quality

The methodology for assessing impacts to air quality from herbicide applications is discussed in detail in the 2007 PEIS (USDOI BLM 2007a:4-6 to 4-8). Additional information on methodology, data sources, and results may be found in the air quality report that was prepared as supporting documentation for the 2007 PEIS (ENSR 2005). The air quality methodology includes calculating annual emissions for the proposed alternatives by state from vehicle exhaust and fugitive dust (from travel on unpaved roads). Emissions were calculated for CO, nitrogen oxides (NO_x), total suspended particulates (TSP), PM_{10}, $PM_{2.5}$, and volatile organic compounds (VOCs). Annual exhaust emissions were determined using emission factor data for vehicles likely to be used in herbicide treatments and for transportation, and assumptions about periods of operation. It should be noted that the 2007 PEIS used 1998 emission factors, and therefore likely overestimates emissions using newer vehicles. Table 4-1 presents the annual emissions for Alternative B of the 2007 PEIS, which carries over to all the alternatives considered in this analysis (as the total treatment acreage would not change). Annual fugitive dust emissions were determined using emission factors that considered trip mileage and soil properties. In this analysis, PSD levels are used to indicate whether the herbicide use alternatives would significantly affect air quality.

The USEPA's California Puff (CALPUFF) "lite" air pollutant dispersion model (a first level screening model referenced in Appendix W of 40 CFR Part 51) was used to provide an example of potential TSP and PM emissions resulting from a single herbicide spraying event. Spray drift from various herbicide application methods was assessed using the AgDrift model.

As the current proposed action adds new active ingredients to the list of herbicides approved for use by the BLM, but does not increase the total amount of

TABLE 4-1
Annual Emissions Summary for Herbicide Treatments Under All Alternatives

State	Pollutant (tons per year)					
	CO	NO_X	TSP	PM_{10}	$PM_{2.5}$	VOCs
Alaska	0.00	0.00	0.00	0.00	0.00	0.00
Arizona	3.40	0.41	14.66	3.09	0.42	0.24
California	0.54	0.06	2.37	0.50	0.07	0.04
Colorado	2.06	0.24	4.88	1.07	0.14	0.18
Idaho	24.22	2.92	60.35	13.18	1.67	1.71
Montana	4.97	0.60	11.58	2.58	0.32	0.35
Nebraska	0.00	0.00	0.00	0.00	0.00	0.00
Nevada	10.81	1.26	47.63	10.18	1.39	0.75
New Mexico	4.85	0.54	17.73	3.97	0.54	0.40
North Dakota	0.00	0.00	0.00	0.00	0.00	0.00
Oklahoma	0.00	0.00	0.00	0.00	0.00	0.00
Oregon (Total)	5.00	0.57	28.77	6.97	0.99	0.34
Eastern	1.31	0.15	2.55	0.56	0.07	0.09
Western	3.87	0.43	26.22	6.40	0.91	0.26
South Dakota	0.08	0.01	0.20	0.05	0.01	0.01
Texas	1.07	0.13	2.46	0.55	0.07	0.08
Utah	2.42	0.28	8.56	1.88	0.25	0.21
Washington	0.43	0.05	1.01	0.23	0.03	0.03
Wyoming	2.42	0.28	5.69	1.24	0.16	0.21
Total	62.27	7.35	205.89	45.49	6.06	4.55
Source: USDOI BLM 2007a.						

herbicide application, a new analysis of emissions of criteria pollutants has not been completed for this PEIS. However, since the 2007 PEIS did not consider GHG emissions, a GHG emission analysis has been completed for this PEIS. Mobile source GHG emissions were estimated using emission factor data for vehicles likely to be used in herbicide treatments and for transportation, using 2009 model year emission factors. A quantitative analysis of carbon sequestration (adsorption of atmospheric carbon dioxide by vegetation and stored in woody biomass) was not conducted, as there is no appropriate protocol for evaluating impacts of land use changes on atmospheric carbon release and sequestration.

Standard Operating Procedures

The 2007 PEIS (USDOI BLM 2007a:4-8 to 4-9) lists SOPs that the BLM follows to minimize the potential adverse effects of herbicide use on air quality. These SOPs would continue to apply to herbicide treatments involving aminopyralid, fluroxypyr, and rimsulfuron:

- Consider the effects of wind, humidity, temperature inversions, and heavy rainfall on herbicide effectiveness and risks.
- Apply herbicides in favorable weather conditions to minimize drift. For example, do not treat when winds exceed 10 mph (6 mph for aerial applications) or rainfall is imminent.
- Use drift reduction agents, as appropriate, to reduce the drift hazard.
- Select proper application equipment (e.g., spray equipment that produces 200- to 800-micron diameter droplets [spray droplets of 100 microns and less are most prone to drift]).
- Select proper application methods (e.g., set maximum spray heights and use appropriate buffer distances between spray sites and non-target resources).

Additionally, all guidance provided in BLM manuals and handbooks would continue to be followed. At the local level, the BLM would consider best management practices (BMPs) to reduce GHG emissions associated with herbicide treatments, as appropriate.

Impacts by Alternative

Impacts Common to All Alternatives

Based on the air quality analysis presented in the 2007 PEIS (USDOI BLM 2007a:4-9 to 4-13), the potential impacts from herbicide applications on local and regional air quality would be minor under all of the treatment alternatives. Additionally, since the total area treated using herbicides would be the same under all of the alternatives, differences in air quality emissions between alternatives would be minor.

Annual Air Quality Emissions

None of the predicted annual emissions by pollutant, state, or alternative would exceed PSD annual emission significance thresholds. Furthermore, under each alternative, the total emissions from all the states for each pollutant would be less than 25 percent of the PSD threshold (250 tons per year) for a single facility. Comparing the total emissions produced by all the states to the PSD threshold is especially conservative because the PSD threshold is designed to apply to one facility or a group of facilities and not entire states. Potential emissions would be highest in states with the greatest number of acres treated. Based on CALPUFF "lite" modeling, all PM concentrations resulting from a single example herbicide spraying event would be substantially lower than NAAQS thresholds at five representative locations, and predicted concentrations would be at least four orders of magnitude smaller than assumed background concentrations (Table 4-2).

Spray Drift and Volatilization

Under all alternatives, atmospheric concentrations of herbicides (predicted by particle size) resulting from spray drift from aerial, ground vehicle, and hand applications would be temporary in nature (most predominant at the time and location of treatment) and, as predicted by modeling, would not significantly impact air quality. Based on modeling, herbicide concentrations in the air tend to increase up to 1.5 kilometers (km) from the point of application (concentrations may double between 0.6 and 1.5 km from the application site), but then decrease slowly at greater distances.

Chemical volatilization is temporary in nature, and none of the currently approved herbicides or the three proposed for use are likely to result in substantial volatilization from soils. Chemical vapor pressure (the pressure exerted by a vapor in equilibrium with its solid or liquid phase) largely affects the potential for volatilization of applied herbicides. Based on their vapor pressures, aminopyralid, fluroxypyr, and rimsulfuron are not expected to volatilize from dry soil surfaces, and are essentially non-volatile from water and moist soil (U.S. National Library of Medicine 2006, 2011, 2012). Therefore, application of these herbicides would not impact air quality through volatilization.

Greenhouse Gas Analysis

Estimated annual GHG emissions from the project were determined based on the methodology described under Methodology for Assessing Impacts to Air Quality, which can be found earlier in this Air Quality and Climate section. Based on projections for trip mileage made for Alternative B of the 2007 PEIS, GHG emissions associated with vehicles (ground and aerial) used to transport and apply herbicides were calculated. More information on the procedures used to estimate emissions, including uncertainties and assumptions, can be found in the *Annual Emissions Inventory for BLM Vegetation Treatment Methods* (ENSR 2005). As the total assumed treated acreage under that alternative (931,850) would be the same under all the alternatives analyzed in this document, there is no difference under the alternatives as far as GHG emissions.

Based on a total herbicide treatment acreage of approximately 932,000 acres, the proposed herbicide treatments would generate approximately 3,333 $MTCO_2e$/yr of CO_2, 14 $MTCO_2e$/yr of N_2O, and 2 $MTCO_2e$/yr of methane (CH_4). Therefore, total GHG emissions associated with the herbicide treatments under all the alternatives is approximately 3,350 $MTCO_2e$/yr. A comparison of this number to total emissions for the western U.S. helps provide an indication of the magnitude of GHG emissions associated with the project. Based on a review of GHG inventories provided by the USEPA (2014), not all 17 states covered in the analysis area have completed an inventory; no data are available for Idaho, Nebraska, North Dakota, or Wyoming. For the remaining 13 states in the western U.S., total combined reported annual GHG emissions is approximately 1,400 MMT (million metric tons) CO_2e/yr. Estimated annual project-related emissions are 0.0002 percent of this total, and 0.00006 percent of the annual national reported GHG emissions of 5,546.3 $MMTCO_2e$/yr. Additionally, annual emissions would be approximately 13 percent of the amount (25,000 $MTCO_2e$/yr) that would require mandatory reporting under the USEPA's GHG Reporting Rule, which is anticipated to capture

TABLE 4-2
Example NAAQS Compliance Analysis for Herbicide Treatments Under All Alternatives

Location	Pollutant	Averaging Period	CALPUFF Concentration ($\mu g/m^3$)	Background Concentration[1] ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS Standard[2] ($\mu g/m^3$)
Tucson, Arizona	TSP	24-hour	2.79E-04	40	40	NA
		Annual	7.65E-07	11	11	NA
	PM_{10}	24-hour	5.47E-04	30	30	150
		Annual	1.50E-06	8	8	50
	$PM_{2.5}$	24-hour	7.21E-05	30	30	35
		Annual	1.97E-07	8	8	15
Glasgow, Montana	TSP	24-hour	1.06E-04	40	40	NA
		Annual	2.90E-07	11	11	NA
	PM_{10}	24-hour	2.36E-04	30	30	150
		Annual	6.48E-07	8	8	50
	$PM_{2.5}$	24-hour	2.82E-05	30	30	35
		Annual	7.74E-08	8	8	15
Winnemucca, Nevada	TSP	24-hour	1.36E-04	40	40	NA
		Annual	3.72E-07	11	11	NA
	PM_{10}	24-hour	2.72E-04	30	30	150
		Annual	7.44E-07	8	8	50
	$PM_{2.5}$	24-hour	3.60E-05	30	30	35
		Annual	9.85E-08	8	8	15
Medford, Oregon	TSP	24-hour	3.75E-03	40	40	NA
		Annual	1.04E-05	11	11	NA
	PM_{10}	24-hour	8.20E-03	30	30	150
		Annual	2.28E-05	8	8	50
	$PM_{2.5}$	24-hour	1.14E-03	30	30	35
		Annual	3.19E-06	8	8	15
Lander, Wyoming	TSP	24-hour	6.08E-05	40	40	NA
		Annual	1.67E-07	11	11	NA
	PM_{10}	24-hour	1.37E-04	30	30	150
		Annual	3.75E-07	8	8	50
	$PM_{2.5}$	24-hour	1.72E-05	30	30	35
		Annual	4.70E-08	8	8	15

[1] PM_{10} data from Table 5 of the Montana Modeling Guideline for Air Quality Permits (November 2007; Montana Department of Environmental Quality 2007). TSP concentrations calculated by multiplying PM_{10} data by 1.33. PM_{10} concentrations are also conservatively used as background concentrations for $PM_{2.5}$.
[2] None of the states analyzed have ambient air quality standards for TSP.
NA = Not applicable; and $\mu g/m^3$ = micrograms per cubic meter.

approximately 85 to 90 percent of national GHG emissions (USEPA 2012d).

In terms of net GHG emissions, it is anticipated that under all of the alternatives, reductions in wildfire risk associated with herbicide treatments would result in indirect reduction in GHG emissions. Smoke from wildfires is a biogenic source of GHG emissions, and wildfires can be exacerbated by certain invasive plants, such as cheatgrass and other annual grasses. Reducing wildfires is identified in the President's Climate Action Plan (Executive Office of the President 2013) as a specific effort to protect natural resources. Wildfires generated approximately 97 MMT CO_2e/yr in 2013 (USEPA 2015), which represented 0.7 percent of total national emissions for that year. Because many factors contribute to wildfire risk, it is not possible to quantify the contribution to net reductions in GHG emissions of the proposed herbicide treatments. However, the reduction in wildfire risk from successful vegetation treatments would be expected to have long-term beneficial effects over many years.

Given the relatively low amount of GHG emissions associated with herbicide treatments, and their role in larger BLM efforts to reduce the frequency, extent, and severity of wildfire, none of the alternatives are expected to have a significant adverse effect on GHG emissions or climate change.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

The No Action Alternative corresponds to the Preferred Alternative in the 2007 PEIS. The air quality analysis for this alternative assumed that 932,000 acres would be treated using herbicides annually. While the BLM has not come close to this maximum acreage since the release of the ROD for the 2007 PEIS, for the purposes of this analysis, the tables from the 2007 PEIS (reprinted as Tables 4-1 and 4-2 in this document) are still considered to be suitable, conservative estimates. As indicated in Table 4-1, total pollutant emissions would include approximately 206 tpy TSP, 62 tpy CO, and 45 tpy PM_{10}. Total GHG emissions would be 3,350 $MTCO_2e$/yr. These emissions would continue to dominate in states with the greatest number of acres treated. While Table 4-1 assumes that the greatest treatment acreage would occur in Idaho and Nevada, in reality more extensive herbicide treatments occurred in New Mexico during 2006 to 2011. However, no states had treatment acres that reached or exceeded the estimate for Idaho. Therefore, Table 4-1 should be used as a guide, with the understanding that the proportion of treatment acres by a state in any given year is likely to shift over time. Idaho, Nevada, New Mexico, Oregon, and Wyoming are likely to continue to be among the states with the greatest annual air quality emissions.

Although not quantified, herbicide treatments under Alternative A would be expected to have a positive effect on air quality by reducing the risk of wildfire. Smoke and wildfire cause short-term impacts to visibility and air quality, predominantly through the release of PM and CO. Actions to reduce wildfire risk would continue to have an indirect effect on air quality, depending on the efficacy of fuels reduction treatments.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under the Preferred Alternative, it is expected the total annual emissions of criteria pollutants and GHGs would be similar to those under the No Action Alternative. With the introduction of the three new active ingredients, the BLM would change its relative use of herbicides, but the total area treated is still assumed to be 932,000 acres. Likewise, it is assumed that there would be no difference in the method of application for the new herbicides. As under the No Action Alternative, it is expected that the greatest release of air quality pollutants would likely occur in Idaho, Nevada, New Mexico, Oregon, and Wyoming.

Benefits to air quality from reduction of wildfire risk would be similar to those under the No Action Alternative. Treatments would continue to target cheatgrass and other fire fuels.

Alternative C – No Aerial Application of New Herbicides

Under this alternative, the new herbicides would not be available for treatments involving aerial application methods. Instead, currently approved herbicides would continue to be utilized for plane and helicopter treatments. Therefore, it is expected that the overall extent of aerial applications would be much the same as at present and under the other action alternatives. Total releases of air quality pollutants, including criteria pollutants and GHGs also would be similar to those under the other alternatives. Similar to Alternatives A and B, it is expected that the greatest release of air quality pollutants would likely occur in Idaho, Nevada, New Mexico, Oregon, and Wyoming.

Benefits to air quality from reduction of wildfire risk would be similar to those under the other alternatives.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under Alternative D, total emissions of air quality pollutants would be much the same as under the other alternatives. Although rimsulfuron would not be available for use under this alternative, currently approved herbicides (such as aminopyralid) would continue to be used to meet treatment goals, and the total area treated with herbicides by aerial and ground methods would be similar to the area treated under the other alternatives. Therefore the total emissions of criteria pollutants and GHGs would be about the same as under the No Action Alternative and the other action alternatives. Similar to the other alternatives, it is expected that the greatest release of air quality pollutants would likely occur in Idaho, Nevada, New Mexico, Oregon, and Wyoming.

Benefits to air quality from reduction of wildfire risk would be similar to those under the other alternatives.

Mitigation for Herbicide Treatment Impacts

No mitigation measures are proposed for air quality at the programmatic level.

Soil Resources

Introduction

Soil is an essential component of natural ecosystems, providing habitat for a great variety of organisms and a medium for plant growth, and protecting downgradient ecosystems by serving as a physical and biological filter of chemicals in the environment (Wild 1993).

Noxious weeds and other invasive vegetation can impact soil function and reduce soil biodiversity. The amount of moisture in the soil can be altered if infiltration is reduced and runoff is increased on sites dominated by invasive plants (Lacey et al. 1989). Many noxious weeds and other invasive plants have relatively sparse canopies, which allow for greater evaporation from the exposed soil than dense vegetative cover. Sites infested with invasive plants often have more extreme soil temperatures that can alter soil moisture regimes. Noxious weeds and other invasive plants may alter soil nutrient availability for native species, alter soil constituents (e.g., soil fungi and bacteria), and slow the rate of natural plant succession (Olson 1999a). Some weeds also produce toxins or allelopathic compounds that can suppress the growth and germination of other plants (Kelsye and Bedunah 1989).

Herbicide applications inevitably result in contact with soils, either intentionally for systemic treatments, or unintentionally as spills, overspray, spray drift, or windblown dust. In addition to direct application, transmission to soil may occur when an herbicide is transported through the plant from sprayed aboveground portions to roots, where it may be released into soil. Also, some herbicides remain active in plant tissue and can be released into the soil during plant decay and result in residual herbicide activity.

Scoping Comments and Other Issues Evaluated in the Assessment

Several scoping comments were concerned with the persistence of the herbicides in soil and residual soil activity, particularly in regard to aminopyralid. Herbicide fate in soil and the potential for transport of the herbicide from the treatment site on wind-blown soil particles were also concerns.

Standard Operating Procedures

The BLM would continue to implement the SOPs identified in the 2007 PEIS to reduce impacts to soil:

- Minimize treatments in areas where herbicide runoff is likely, such as steep slopes when heavy rainfall is expected.
- Minimize use of herbicides that have high soil mobility, particularly in areas where soil properties increase the potential for mobility.
- Do not apply granular herbicides on slopes of more than 15 percent where there is the possibility of runoff carrying the granules into non-target areas.

In addition, the BLM follows practices, when implementing herbicide treatments, which help minimize effects to soil. The BLM considers herbicide and target site characteristics to determine the suitability of the herbicide at that location. Knowledge of herbicide persistence, mobility, and adsorption are included in herbicide selection. Additionally, herbicide applications are timed in relation to soil moisture and anticipated weather conditions to reduce the potential for off-site transport. Herbicide applications are avoided when the soil moisture status and site characteristics increase the possibility of runoff or deep percolation.

Factors that Influence the Fate, Transport, and Persistence of Herbicides in Soil

The fate and transport of herbicides in soil is a function of their interaction with the soil environment, and is generally considered a complex process (Bovey 2001). Chemical, physical, and biological soil processes influence herbicide availability, phytotoxicity, and fate and transport. Herbicides dissipate from soils by transport with water or wind, through chemical or biological degradation processes, or by immobilization through adsorption onto soil surfaces. These processes are discussed in more detail in the 2007 PEIS (USDOI BLM 2007a:4-14 to 4-15). The estimated half-life and soil adsorption (organic carbon-water partitioning coefficient) of the three herbicides considered in this PEIS are presented in Table 4-3.

TABLE 4-3
Estimated Soil Half-life (Aerobic Conditions) and Adsorption Affinity for Active Ingredients

Herbicide	Soil Half-life (days)	Soil Adsorption (K_{oc})
Aminopyralid	32 to 533	1.05 to 24.3 mL/g
Fluroxypyr	7-23	50 to 136 mL/g
Rimsulfuron	5 to 40	19 to 74 mL/g

Sources: USEPA 2005b, New York State Department of Environmental Conservation (NYSDEC) 2009, U.S. National Library of Medicine 2011.
mL/g = milliliters per gram.

Soil structure affects water movement and may allow herbicides to move through the soil profile before being absorbed or degraded. Large soil cracks or openings can cause rapid herbicide movement. Soil texture affects the surface charge and the surface area for pesticide adsorption. Soils with a higher clay content have a greater ability to hold pesticides, but are more susceptible to runoff. Sandy soils leach more readily and provide fewer sites for pesticide adsorption. Organic matter content is considered the most important soil property affecting pesticide adsorption. Pesticides are very strongly attracted to the surface of organic matter and are less likely to leach in soils high in organic matter.

Summary of Herbicide Impacts

The following section discusses impacts to soil from the three active ingredients proposed for use. This assessment of impacts assumes that SOPs listed in the 2007 PEIS (USDOI BLM 2007a:Table 2-8) would be followed when using the three herbicides. These procedures, which have designed to reduce potential unintended impacts to soil, include using the lowest effective application rate; testing smaller areas for unintended consequences prior to treating larger areas; evaluating soil characteristics to determine the likelihood of herbicide transport by runoff, infiltration, or wind; limiting herbicide use on fine-textured and sandy soils, especially where soil can be transported onto adjacent areas, potentially harming non-target vegetation; and carefully evaluating the use of herbicides on hot, dry, cold, wet, sodic (containing high levels of sodium), and saline (containing high levels of salts) soils.

Herbicides may indirectly affect soil through plant removal, resulting in changes in physical and biological soil parameters. As vegetation is removed, there is less plant material to intercept rainfall and less to contribute organic material to the soil. Loss of plant material and soil organic matter can increase the risk of soil susceptibility to wind and water erosion. The risk for increased erosion would be temporary, lasting only until vegetation is reestablished. If herbicide treatments lead to revegetation with native plants, soil stability may be improved relative to sites dominated by invasive plants.

Use of herbicides to manage noxious weeds and other non-native, invasive species could benefit soil. Invasive plants can increase the potential for wind or water erosion by altering fire frequency or producing chemicals that directly affect soil quality or organisms. Negative effects associated with invasive plant species include increased sediment deposition and erosion, and alteration of soil nutrient cycles (Bossard et al. 2000). For example, soft brome changes the physical characteristics of soil and alters the cycling of carbon and nitrogen (Norton et al. 2004).

Cheatgrass and other annual grasses increase the risk of fire, so control of these species can minimize risk of fire damage to soil. Soil can be damaged by fire through changes to its structure, particularly through the loss of organic matter, which can occur even at relatively low temperatures. The loss of soil structure increases the bulk density of the soil and reduces its porosity, thereby reducing soil productivity and making the soil more vulnerable to postfire runoff and erosion (Neary et al. 2005).

The potential effects of herbicides on biological soil crusts are discussed in the 2007 PEIS (USDOI BLM 2007a:4-15 to 4-16). Past studies have shown both positive and negative effects to biological soil crusts as a result of herbicide treatments. Cyanobacteria, lichen, and moss constituents may be impacted to varying degrees. However, use of herbicides can also benefit biological soil crusts by preventing the invasion of annual grasses, which reduce biological crust cover. The BLM's guidance manual on biological soil crusts instructs that caution should be used when applying herbicides to soils that support these crusts (Belnap et al. 2001).

Impacts of Aminopyralid

Aminopyralid is broken down in the soil by microbes and sunlight. Studies of aminopyralid show a wide range of soil half-lives under aerobic conditions (from 5 to 533 days; as summarized in AECOM 2015). Given the variability, there is some uncertainty as to how long this active ingredient persists in the environment after application. Dow AgroSciences (2005) lists the average half-life for aminopyralid at 34.5 days for North American soils. A recent study in Colorado found that the half-life of aminopyralid was approximately 29 days, with no appreciable herbicide residue left after 1 year (Lindenmyer 2012). It is expected that aminopyralid remains active in the soil for a month or more after application, and may have residual activity during this time.

Based in its low toxicity to terrestrial invertebrates (AECOM 2015), aminopyralid is believed to be of low toxicity to soil macroorganisms. However, there is a lack of information about its toxicity to soil microorganisms, and about associated long-term effects to soil productivity.

Aminopyralid is persistent in plant materials and the manure of animals that have eaten plant materials treated with this herbicide. Therefore, compost and mulch made from contaminated plants and/or manure, if applied to soil, can adversely affect crops and other plantings (Washington State University Extension 2011). These contaminated materials should not be used as soil amendments.

Aminopyralid is weakly sorbed (attached by physical or chemical processes) to soil (Fast 2010), and therefore is unlikely to be transported off-site in large amounts on wind-blown soil.

Impacts of Fluroxypyr

Fluroxypyr is rapidly degraded in soil by microorganisms, with reported half-lives of 1 week to 23 days under aerobic conditions (Lehmann 1991, USEPA 1998a, National Library of Medicine 2011). In one study, only 1 percent of the active ingredient was detected after 3 months (Brumhard and Fuhr 1992 *cited in* National Library of Medicine 2011). Fluroxypyr is mobile to very mobile in soil, but its movement is reduced by its quick microbial degradation. Fluroxypyr has very minimal residual soil activity.

Fluroxypyr has two major metabolites: a pyridine and a methoxypyridine. Fluroxypyr degrades first to the pyridine and then to the methoxypyridine, which is persistent in soil (Lehmann 1991; Cederlund et al. 2012). This second degradate has a high tendency to adsorb to soil, and is slowly degraded in place by microbial degradation and volatilization (Lehmann 1991). In one study, no significant degradation of the second degradate was observed after 350 days (Cederlund et al. 2012); however, another study observed soil half-lives of 90 to 570 days under various laboratory conditions (Lehmann et al. 1990).

Based in its low toxicity to terrestrial invertebrates (AECOM 2014a), fluroxypyr is believed to be of low toxicity to soil macroorganisms. However, there is a lack of information about its toxicity to soil microorganisms. Long-term effects to soil productivity and biological processes are not known.

Given its rapid degradation, high mobility in soil, and minimal residual activity, there would be a low risk of transport of fluroxypyr off of the treatment site in windblown soil. The amount adsorbed to soil would be much less than the amount applied to the treatment site, and would rapidly dissipate. The second degradate would persist for longer and could be transported off the treatment site.

Impacts of Rimsulfuron

Rimsulfuron breaks down rapidly in soil, with aerobic metabolism the primary route of degradation. In aerobic conditions, it has a soil half-life of 5 to 40 days, and in anaerobic conditions, it has a soil half-life of 18 days (NYSDEC 2009). Its mobility in soil ranges from moderate in clay and silt loams to very mobile in sandy loams.

One study of rimsulfuron found that it is poorly mineralized, and that degradation products have the potential to accumulate in soil. Rimsulfuron degrades into a first metabolite, which then degrades rapidly into a second metabolite. The second metabolite is not readily degraded (Metzger et al. 1998). In one study of an aerobic soil environment, there was no decline in this chemical after 1 year. There is no indication that this degradate exhibits toxicological properties (NYSDEC 2009).

One study of rimsulfuron found that there were no adverse effects to the microflora of agricultural soils for standard application rates of the herbicide (Radivojevic et al. 2011). At much higher application rates, minor, transitory adverse effects to soil microorganisms were observed, indicating that short-term adverse effects to soil could occur under accidental spill scenarios. Long-term effects to soil productivity and biological processes are not known.

Rimsulfuron's tendency to adsorb to soil varies by soil type, and is greatest in soils with high organic matter or clay content (Metzger et al. 1998). Therefore, there is some potential for transport off-site on soil particles, although clay and high-organic soils would likely have a relatively low potential for wind erosion.

Impacts by Alternative

The BLM proposes use of herbicides to treat vegetation to improve ecosystem function and health, including soil health. However, herbicide treatments can also affect soil fertility and function, and can kill or harm soil organisms. The benefits and risks to soil under each alternative are discussed in the following sections.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under the No Action Alternative, the BLM would continue its vegetation treatment programs, using only the 18 currently approved herbicides. Herbicide treatments would have both beneficial and adverse effects on soil, as discussed in the previous sections. Herbicides would continue to be used on approximately 932,000 acres annually.

Of the 18 active ingredients that would be used under this alternative, those that are most persistent in soil include diquat, diuron, hexazinone, imazapic, imazapyr, picloram, and tebuthiuron (USDOI BLM 2007a:Table 4-7). Diquat has a half-life of 3 years or longer, but its use would continue to be minimal (less than 1 percent of all acres treated). Tebuthiuron has a half-life of roughly 1 year. Its use would constitute approximately 13 percent of all acres treated under the No Action Alternative. Other herbicides with half-lives of 90 days or greater would make up approximately 30 percent of all herbicide treatment acres.

Under this alternative, the herbicides with the most extensive use on BLM lands would be imazapic (20 percent), triclopyr (15 percent), clopyralid (13 percent), and tebuthiuron (13 percent; see Table 2-4). Impacts to soil from these herbicides are discussed in the 2007 PEIS (USDOI BLM 2007a:4-16 to 4-21). None of these herbicides have been found to have substantial impacts on soil or soil organisms. Tebuthiuron is extremely persistent in soil, and has been detected at application sites more than 10 years after application (Gay et al. 1997 *cited in* USDOI BLM 2007a).

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under the Preferred Alternative, the total area receiving herbicide treatments would remain the same (932,000 acres), but the suite of chemicals used at individual sites would change with the introduction of aminopyralid, fluroxypyr, and rimsulfuron into treatment programs. Aminopyralid would be used on approximately 10 percent, and rimsulfuron on approximately 16 percent, of all acres treated. Use of fluroxypyr would be minimal (1 percent of all acres). Fluroxypyr and rimsulfuron have relatively short half lives in soil (Table 4-3). Aminopyralid also has a fairly short half-life, but there is evidence that it may be quite persistent (with a half-life of more than a year) under certain site conditions. Additionally, plant materials and residues that have been treated with aminopyralid may continue to release aminopyralid to the soil until these materials have decomposed. None of the new herbicides proposed for use have been found to have substantial impacts on soil or soil organisms.

With the addition of the three new herbicides, use of some previously-approved herbicides is expected to decrease, as shown in Table 2-4. Under the Preferred Alternative, use of glyphosate, imazapic, and picloram would decrease by an estimated 4 to 10 percent of the total acres treated. Imazapic and picloram have fairly long half-lives, relative to the new herbicides. Therefore, the overall persistence of herbicides in soil could be reduced under the Preferred Alternative. Overall, potential adverse effects to soil and soil organisms would be minor, although potentially less than those under the No Action Alternative.

If availability of the new herbicides were to increase the efficacy of the BLM's vegetation treatment programs, resulting in better control of noxious weeds and of invasive species that increase fire frequency, there may be a slightly greater benefit to soil resources than under the No Action Alternative.

Alternative C – No Aerial Application of New Herbicides

Under Alternative C, vegetation treatments would utilize the same suite of chemicals as under Alternative B, and the same maximum number of acres as under the other alternatives, but a restriction on aerial application of the new herbicides would result in slight differences in the relative amounts of herbicides used. As shown in Table 2-4, use of the new herbicides would be less than under the Preferred Alternative, and the associated reductions in use of glyphosate, imazapic, and picloram would also be less. Therefore, overall persistence of herbicides in soil would fall somewhere between the No Action Alternative and the Preferred Alternative. Impacts to soil would be minor, similar to the other alternatives.

Benefits to soil resources could be slightly greater than under the No Action Alternative, and slightly less than under the Preferred Alternative.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under this alternative, the BLM would not add rimsulfuron to its list of approved active ingredients. However, all currently approved ALS-inhibiting herbicides would continue to be used. As a result, the breakdown of herbicide usage would be very similar to that under the No Action Alternative. Because rimsulfuron would not be available to manage cheatgrass and other winter annuals, the BLM would continue to rely heavily on imazapic for these uses. With the introduction of aminopyralid, use of glyphosate would be reduced. Glyphosate and aminopyralid have similar soil half-lives, and under certain conditions aminopyralid may be more persistent than glyphosate. Overall, impacts to soil resources would be minor, and would be very similar to those under the No Action Alternative. It is expected that benefits to soil from control of noxious weeds and other invasive vegetation also would be similar to those under the No Action Alternative.

Mitigation for Herbicide Treatment Impacts

No mitigation measures are proposed for soil resources.

Water Resources and Quality

Introduction

The proposed herbicide treatments have the potential to affect water resources on or near public lands by altering water flows, surface water and groundwater quantity and quality, and rates of groundwater recharge. Surface water provides an important source of drinking water, provides habitat for fish and wildlife, and is used for recreation. Groundwater has numerous uses, including irrigation, drinking water (for humans and livestock), domestic needs, aquaculture, and other uses (USGS 2013). Approximately 44 percent of the U.S. population depends on groundwater for its drinking water supply (National Groundwater Association 2010).

Studies have shown some groundwater supplies to be contaminated with herbicides and other contaminants (e.g., total dissolved solids and metals). Generally, shallow groundwater aquifers are at greater risk for contamination than deeper sources. As discussed in the 2007 PEIS (2007a:3-15 to 3-18) and Chapter 3 of this PEIS, water quality is poor to moderate over many areas in the West, primarily in areas associated with agricultural activities. Thus, actions that further deteriorate water quality or watershed health need to be carefully evaluated before being implemented on public lands.

Scoping Comments and Other Issues Evaluated in the Assessment

Scoping comments were concerned about the potential for the new herbicides to adversely affect water quality. Comments addressed herbicide drift, erosion of contaminated soils into waterways, and contamination of surface water, groundwater, and drinking water. One comment noted that aminopyralid has been detected in surface water in Montana. Another comment inquired about how invasive infestations of aquatic plants would be controlled (to prevent deterioration of water quality) if buffers are required around water bodies for treatments involving the new herbicides.

One comment mentioned the requirements of the Clean Water Act, and requested that the BLM show that use of the new herbicides would not result in degradation of water quality of Section 303(d)-listed waters, and indicate how other anti-degradation provisions of the Clean Water Act would be met.

Other commenters showed support for the new herbicides by noting that they are safe to use around water and have a low risk of resulting in water contamination.

Standard Operating Procedures

The BLM would continue to implement the SOPs identified in the 2007 PEIS to reduce unintended impacts to water quality and quantity from the application of herbicides:

- Consider climate, soil type, slope, and vegetation type when developing herbicide treatment programs.
- Note depths to groundwater and identify areas of shallow groundwater and areas of surface water and groundwater interaction.
- Review hydrogeologic maps of proposed treatment areas or conduct site reconnaissance to identify areas of shallow groundwater.
- Select herbicide products to minimize impacts to water. This is especially important for application scenarios that involve risk from active ingredients in a particular herbicide, as predicted by risk assessments.
- Use local historical weather data to choose the month of treatment. Based on the phenology of the target species, schedule treatments based on the condition of the water body and existing water quality conditions.
- Plan to treat between weather fronts (calms) and at the appropriate time of day to avoid high winds that increase spray drift and water movements, and to avoid potential stormwater runoff and water turbidity.
- When possible, plan to treat shallow areas, which are easier to control.
- Conduct mixing and loading operations in an area where an accidental spill would not contaminate an aquatic body.
- Do not rinse spray tanks in or near water bodies.
- Do not broadcast pellets where there is danger of contaminating water supplies.
- Minimize treating areas with high risk for groundwater contamination.
- As needed, maintain buffers between treatment areas and water bodies. Buffer widths should be developed based on herbicide- and site-specific criteria to minimize impacts to water bodies.
- Minimize the potential effects to surface water quality and quantity by stabilizing terrestrial areas as quickly as possible following treatment.

These SOPs are general to herbicide treatments, and would apply to treatments with the three new active ingredients, as applicable.

Additionally, the ROD for the 2007 PEIS has identified two mitigation measures for herbicide treatments that apply to the three new active ingredients:

- Establish appropriate (herbicide-specific) buffer zones to downstream water bodies, habitats, and species/populations of interest. These buffer zones are based on information provided in the risk assessments indicating the minimum safe distance to protect aquatic organisms.
- Areas with potential for groundwater for domestic or municipal water use shall be evaluated through the appropriate, validated USEPA model(s) to estimate vulnerability to potential groundwater contamination, and appropriate mitigation measures shall be developed if such an area requires the application of herbicides and cannot otherwise be treated with nonchemical methods.

As a result of a court ruling in 2011, the National Pollution Discharge Elimination System (NPDES) regulations no longer provide an exemption for discharges of pesticides that leave a residue into Waters of the U.S. Therefore, NPDES permits are now required for application of pesticides in or near aquatic habitats in states where BLM herbicide treatments would occur. Necessary NPDES permits would be obtained at the local level for proposed herbicide treatment projects, in accordance with the requirements detailed on the USEPA's NPDES Pesticide Homepage (http://water.epa.gov/polwaste/npdes/pesticides/index.cfm).

Summary of Herbicide Impacts

Aminopyralid, fluroxypyr, and rimsulfuron would only be used on terrestrial vegetation; none of these herbicides are currently approved for aquatic uses. Aminopyralid, however, may receive an aquatic registration in the near future that would address incidental overspray of this active ingredient during treatment of vegetation within close proximity to wetland and riparian vegetation. Aminopyralid would not be used to manage aquatic vegetation as a result of this registration, and would not be applied directly to the water column like other aquatic herbicides.

Impacts to Water Quality

The primary means of off-site movement of terrestrial herbicides to water are runoff, leaching, drift, and misapplication/spills. If aminopyralid receives an aquatic registration, it could also reach water through incidental overspray (direct spray). Surface water could be affected by any type of off-site herbicide movement, while groundwater potentially would be affected only by leaching. Site conditions and application technique can also influence the effects of an herbicide on water quality. Pollution results from herbicide concentrations that are elevated enough to impair water quality and the beneficial use of the impacted water (USDOI BLM 1991). The 2007 PEIS (USDOI BLM 2007a:4-26 to 4-29) goes into detail about the general ways by which herbicides can impact water quality by the four means of off-site movement. This information is summarized in the following paragraphs.

Runoff and Leaching. Three physical properties, in combination with climate, geology, and topography, determine the runoff and leaching potential of an herbicide: 1) persistence (the time a chemical stays active); 2) soil adsorption (the tendency of a chemical to bind to soil particles); and 3) solubility (the tendency of a chemical to dissolve in water; Bonneville Power Administration 2000).

Table 4-4 lists the factors associated with herbicide movement to groundwater, and Table 4-5 lists the physical properties of the three active ingredients proposed for use and the associated off-site movement potential via leaching and runoff. Herbicides must be relatively persistent to have the potential to leach or run off. Herbicides that adsorb strongly to soil particles (because of herbicide and/or soil properties) tend to run off with soil movement. Soils high in organic content or clay tend to be the most adsorptive, while sandy soils low in organic content are typically the least adsorptive (USDOI BLM 1991). Herbicides with low soil adsorption tend to leach down through the soil, although herbicides with low solubility in water may be more likely to run off. Site characteristics that may affect the likelihood of an herbicide reaching a water body via runoff or leaching include amount of precipitation, depth to groundwater, and soil type.

Drift. The airborne movement of herbicides beyond the treatment area is one mode of potential surface water contamination. The application technique, weather conditions, and applicator error can all contribute to drift. Broadcast treatments from an aircraft or a boom are more likely to drift from the treatment area than spot and localized treatments. The potential for drift is also increased during warm temperatures and wind speeds greater than 5 mph (Bonneville Power Administration 2000). Because of the potential for drift, buffers between the treatment site and nearby water bodies may be specified to protect aquatic species.

TABLE 4-4
Factors Associated with Herbicide Movement to Groundwater

Category	Properties Increasing Likelihood of Groundwater Detection
Herbicide properties	Greater mobility (lower adsorption) Greater pesticide persistence (lower reactivity)
Agricultural management practices	Higher pesticide use Increasing proximity to pesticide application areas Reductions in depth or frequency of tillage
Well characteristics	Decreasing well depth Dug or driven (versus drilled) wells Poorer integrity of surficial or annular well seals
Hydrogeologic and edaphic factors	Unconsolidated aquifer materials (versus bedrock) Decreasing depth of upper surface of aquifer Decreasing thickness or absence of confining layers Higher hydraulic conductivity Higher soil permeability Increased recharge (from precipitation or irrigation) Younger groundwater age
Source: Barbash et al. 1999.	

TABLE 4-5
Herbicide Physical Properties and Off-site Movement Potential

Herbicide	Physical Properties			Off-site Movement Potential	
	Persistence	Solubility (mg/l)	Adsorption (Koc)	Groundwater Leaching	Surface Water Runoff
Aminopyralid	Moderate	2,480	1 to 24	High	High
Fluroxypyr	Low	7,300	50 to 136	Low	Low
Rimsulfuron	Low	7	19 to 74	Low	Low

Note: The information in this table applies to the active ingredient itself, not the degradation products.
Sources: USEPA 2005c, NYSDEC 2009, U.S. National Library of Medicine 2011, 2012.

Misapplications and Spills. Herbicides registered for use in terrestrial habitats may affect surface water and groundwater as a result of unintentional spills or accidental direct spray of water. Most experts agree that misapplications and spills are the leading cause of impacts to non-target resources. Misapplications and spills are caused by failure to follow label instructions and restrictions, unforeseen conditions and accidents, and by applicator carelessness. The impacts of a spill depend on the persistence and mobility of the spill, as well as how quickly the spill is cleaned up.

Other Factors. Additional factors that may influence the potential for herbicides to affect water quality include the following:

- Type of water body (small and still water bodies versus large and fast-moving rivers);
- Amount of rainfall;
- Type of vegetation (thick vegetation versus little to no vegetation); and
- Application technique (aerial/broadcast versus spot treatments).

Herbicides can also affect water quality by contributing to increased nutrient loading to surface water and groundwater. Nutrient enrichment of aquatic systems can lead to algal blooms and eutrophication (mineral and organic nutrient loading and subsequent proliferation of plant life), resulting in decreased dissolved oxygen content.

Benefits to water quality from herbicide treatments are associated with a reduced risk of fire and post-fire sedimentation. Additionally, control of invasive species in terrestrial and aquatic systems can provide long-term benefits to water quality with the return of more stable soils, attenuated nutrient cycling, and a return to normal fire cycles.

Impacts to Water Quantity

Removal of vegetation through use of herbicides has the potential to affect water quantity by altering the magnitude of base flows and the frequency and magnitude of peak flows. Such effects would be most likely to occur as a result of large-scale removal of vegetation as a result of broadcast spraying. For some treatment areas, the removal of vegetation could improve groundwater recharge by limiting the amount of water lost through sublimation or plant evapotranspiration. In this case, base flows, which are dependent on the quantity of groundwater discharge, would increase. These changes could be very minor or short-lived if the vegetation did not evapotranspirate or sublimate large proportions of precipitation, or if areas were revegetated quickly (Satterlund and Adams 1992).

Under some circumstances, large-scale removal of vegetation could result in the reduction of groundwater discharge and base flow as a function of reduced infiltration rates. Reduced infiltration rates result in more surface runoff reaching streams and lakes immediately after a rain event, thus increasing the velocity, frequency, and magnitude of peak stream flows. These changes in water quantity could alter the physical characteristics of stream channels and affect the speed of water movement. Changes would persist until the site was revegetated.

Impacts by Herbicide

The 2007 PEIS discusses the impacts to water resources for each of the 18 currently approved herbicides (USDOI BLM 2007a:4-29 to 4-34). The impacts of the three new herbicides are discussed in the following sections.

Aminopyralid

Aminopyralid is moderately persistent and has high mobility in most soils because of its low soil adsorption values (Table 4-5; USEPA 2005c). Therefore, it is transported to surface water and groundwater. Breakdown by microbes in soil is the primary form of dissipation. Aminopyralid's mobility and high water solubility suggest that the herbicide is prone to leaching (Lindenmeyer 2012). However, in past studies, leaching of aminopyralid has not been documented at levels below 1 foot (USEPA 2005b).

In water, aminopyralid is stable and does not readily react with water, but is broken down by sunlight. The half-life by photolysis is very short, at 0.6 days (USEPA 2005b). Therefore, it is expected that aminopyralid rapidly dissipates in clear, shallow surface water (USEPA 2005c). Within fast-moving water it rapidly dissipates through mixing. The major metabolic products of photolysis in water are oxamic acid and malonamic acid, neither of which would form in large concentrations, or are of concern from a toxicity standpoint (USEPA 2005b).

Once aminopyralid leaches down to anaerobic soil depths, degradation is likely to slow, which could be a factor in groundwater contamination (USEPA 2005c). At one study in Montana, aminopyralid was detected in groundwater in one of 23 wells (Schmidt and Mulder 2009), indicating that there is some risk of groundwater contamination. It is expected that concentrations of aminopyralid in groundwater would be greatest in areas with a high water table and when rainfall happens immediately after application (USEPA 2005c).

Neither aminopyralid nor its major metabolic products are included on the USEPA's list of drinking water contaminants (USEPA 2013b).

Because of its moderate persistence, high mobility, and low soil adsorption, aminopyralid has a high potential for surface water runoff. A Forest Service risk assessment for this active ingredient determined that in areas with high annual rainfall virtually all of the aminopyralid applied to a site could be transported offsite in surface runoff (Syracuse Environmental Research Associates, Inc. 2007).

Fluroxypyr

Based on soil adsorption characteristics, fluroxypyr is expected to have a high mobility in soil. However, it has a low potential for movement to groundwater because it is rapidly broken down by microbes in the soil (soil half-life is 1 to 3 weeks; California Department of Pesticide Regulation 2005; U.S. National Library of Medicine 2011). In field studies submitted to the USEPA, fluroxypyr was generally not found below a soil depth of 6 inches (USEPA 1998a), although this may vary depending on soil type and amount of rainfall. In sandy soils, the potential to leach to groundwater is much higher, and has been identified as a concern (NYSDEC 2006). Factors that influence the rate of fluroxypyr degradation in soils include soil microbes, organic matter, temperature, and soil moisture (Tao and Yang 2011).

In water, fluroxypyr does not readily break down by photolysis, but is biodegraded by microorganisms in the water and undergoes hydrolysis under certain conditions. The aquatic half-life is fairly short, at 5 to 14 days (U.S. National Library of Medicine 2011).

The two major biotransformation products of fluroxypyr (a pyridine and a methoxypyridine), may be more persistent in water than fluroxypyr (Health Canada 2012). Studies of fluroxypyr in Sweden detected both fluroxypyr and pyridine in the groundwater beneath a railway treatment site (Cederlund et al. 2012).

Neither fluroxypyr nor its two major biotransformation products are included on the USEPA's list of drinking water contaminants (USEPA 2013b).

Because of its quick rate of breakdown, fluroxypyr is expected to have a low risk of surface water runoff. A Forest Service risk assessment for this active ingredient determined that up to 10 percent of applied herbicide would leave a site in surface water runoff in areas with clay soils and high rates of rainfall. For most other soils, about half this amount was expected to run off, with virtually no runoff from predominantly sandy soils (Syracuse Environmental Research Associates, Inc. 2009).

Rimsulfuron

As discussed in the soil resources section, rimsulfuron is unstable in soil, and therefore likely has a low risk of leaching to groundwater. The pH of the site conditions are likely a factor, with rimsulfuron less mobile in acidic conditions. Its metabolites may have a greater likelihood of contaminating groundwater, particularly the second metabolite, which is not readily degraded (Metzger et al. 1998).

There is little available information about rimsulfuron and its metabolites in terms of groundwater and surface water contamination. One study in sandy soils found no rimsulfuron in groundwater following an herbicide application, but did find the first metabolite in the soil water at a depth of 3.3 feet, for as long as 3 years, in concentrations unsafe for drinking water. Concentrations of the second metabolite were much lower (Rosenbom et al. 2010).

In aquatic systems, rimsulfuron is broken down via biodegradation and photodegradation. The biodegradation half-life is estimated at 10 days under aerobic conditions (NYSDEC 2009).

Neither rimsulfuron nor its two metabolites are included on the USEPA's list of drinking water contaminants (USEPA 2013b).

Given its fairly rapid dissipation rate in the soil, rimsulfuron has a low risk of surface runoff. If a rain event were to occur a week after application of rimsulfuron, only a very small portion of the active ingredient would be available for movement (NYSDEC 1997).

Impacts by Alternative

Under all alternatives, one goal of herbicide treatments would be to reduce noxious weeds and other invasive species to improve watershed condition and protect watersheds from wildfire. The BLM would also strive to increase the number/acreage/miles of properly functioning wetland/riparian areas to benefit water quality. Work to restore degraded habitat and native plant communities would be expected to benefit water resources under all alternatives.

By minimizing fire risk through management of cheatgrass and other winter annual grasses, the risk of post-fire sedimentation into aquatic habitats would also be minimized. When soils are carried into lakes and streams, water quality diminishes as a function of increased sedimentation and turbidity (USDOI BLM 2000). Additionally, some invasive vegetation, such as pinyon and juniper, reduces water availability for native species (USDOI BLM 1999). Furthermore, annual grasses reduce the overall vegetative cover in a watershed, relative to native grasses, which leads to reduced infiltration, increased runoff, and loss of soil moisture. Eventually, soils are transported to streams and other aquatic bodies, increasing sedimentation and reducing water quality. The benefits associated with herbicide treatments that reduce the cover of non-native invasive species would occur under all alternatives.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under the No Action Alternative, the BLM would continue its vegetation management programs using the current list of 18 herbicides. The use of individual herbicides may vary somewhat from historic usage based on identified future projects, as summarized in Table 2-4. The estimated total land area treated with herbicides would remain at 932,000 acres annually. The impacts under this alternative were summarized in the 2007 PEIS (USDOI BLM 2007a:4-35). In general, herbicide treatments would provide benefits to water resources by managing invasive species that damage watersheds.

Approved aquatic herbicides would continue to be applied directly to water to control aquatic species. The 2007 PEIS identified concerns associated with use of the known groundwater contaminants 2,4-D, bromacil, dicamba, diquat, diuron, hexazinone, and picloram. Other herbicides were identified as having the potential to leach to groundwater or be carried to surface water in stormwater runoff.

Under this alternative, use of clopyralid, glyphosate, imazapic, tebuthiuron, and triclopyr would comprise herbicide treatments on approximately 73 percent of all acres treated. Based on information in the 2007 PEIS, glyphosate is a known groundwater contaminant, persists in aquatic environments, and may stimulate algal growth in low concentrations. There are fewer concerns about the other herbicides in this list, although imazapic is believed to be a groundwater contaminant, and tebuthiuron has been detected in surface water. Concerns associated with use of these herbicides would continue under this alternative. The impact summary for this alternative in the 2007 PEIS was that there would be some risks to water resources from herbicide treatments, as well as benefits associated with watershed improvements.

Alternative B –Allow For Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, the extent of herbicide treatments would be the same as under the No Action Alternative, with associated risks to water resources over roughly the same geographic area. However, the suite of herbicides used would be slightly different. Aminopyralid, fluroxypyr, and rimsulfuron would be added to the list of herbicides used to treat vegetation. Therefore, the number of chemicals with the potential to impact water resources would increase under this alternative. None of the new herbicides are groundwater or drinking water contaminants of concern, although the potential for such contamination by these herbicides and their degradation products exists.

Use of some previously-approved herbicides would decrease under this alternatives, primarily that of glyphosate, imazapic, and picloram. The use of the known groundwater and drinking water contaminants, glyphosate and picloram, would decrease by 7 percent and 4 percent, respectively, meaning that roughly 11 percent fewer acres would be treated with these herbicides than under the No Action Alternative. Use of imazapic, a possible groundwater contaminant, would decrease by 10 percent. Use of all other currently approved herbicides would be the same as or within 3 percent of the current level of usage.

Under this alternative, use of fluroxypyr would be low (approximately 1 percent of all acres treated), but use of aminopyralid and rimsulfuron would account for 26 percent of all acres treated. As discussed in the Impacts by Herbicide section, there may be some risk of groundwater contamination associated with aminopyralid and the degradation products of rimsulfuron. Based on the available information, these risks are likely lower than those associated with glyphosate and picloram, indicating that effects to water resources may be reduced under this alternative, relative to the No Action Alternative.

None of the new herbicides would be used to manage aquatic vegetation. Therefore, the level of benefit to water resources from control of unwanted aquatic vegetation, such as Eurasian watermilfoil, would be the same as under the other alternatives. If availability of the new herbicides were to increase the efficacy of the BLM's vegetation treatment programs, resulting in an improvement in watershed condition, water resources could receive a higher degree of benefit from treatment programs than under the No Action Alternative.

Alternative C – No Aerial Application of New Herbicides

Under this alternative, total maximum herbicide use would be the same as under the other alternatives (932,000 acres), but aerial applications of aminopyralid, fluroxypyr, and rimsulfuron would not be allowed. The number of chemicals with the potential to impact water resources would be the same as under the Preferred Alternative. However, use of glyphosate, picloram, and imazapic would decrease by approximately 9 percent, which is less of a decrease than under the Preferred Alternative. Aminopyralid and fluroxypyr would only be used on an estimated 9 percent of treatment acres. Therefore, reduction in risks to water resources through a reduction in use of known contaminants would be less under this alternative than under the Preferred Alternative.

Watershed-level benefits to water resources could be slightly greater than under the No Action Alternative, and slightly less than under the Preferred Alternative. Not being able to apply the new herbicides aerially would limit their usefulness in certain situations, although these needs would continue to be met through aerial applications of currently approved herbicides.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under Alternative D, total herbicide use would be the same as under the other alternatives. However, without the option of rimsulfuron, the percent of land area treated with the new herbicides would be the lowest of all the action alternatives, at approximately 11 percent (10 percent for aminopyralid and 1 percent for fluroxypyr). This alternative is the closest to the No Action Alternative in terms of how much of each of the currently available herbicides would be used. Most of the currently available herbicides would be used at levels similar to those under the No Action Alternative, with the biggest reductions in use of picloram (4 percent reduction) and metsulfuron methyl (3 percent reduction). There could be some reduced risks to water quality as a result of a decrease in the use of picloram, but glyphosate would continue to be used at nearly the same level as under the No Action Alternative.

The number of chemicals with the potential to impact water resources would be greater than under the No Action Alternative, but less than under the Preferred Alternative and Alternative C.

Watershed-level benefits would be similar to those under the No Action Alternative.

Mitigation for Herbicide Treatment Impacts

No new mitigation measures, or measures specific to the three new herbicides, are proposed for water resources.

The BLM's SOPs to protect water resources would continue to be implemented. These include procedures designed to prevent accidental spills of herbicides into aquatic habitats.

Wetland and Riparian Areas

Introduction

Herbicide treatments have the potential to alter vegetation, hydrology, or soils in wetland and riparian areas, affecting the functions of these areas. However, herbicide treatments that control non-native species in wetland and riparian habitats would be beneficial. Invasive plant species are one cause of degradation in the function of wetland and riparian areas.

Scoping Comments and Other Issues Evaluated in the Assessment

Scoping comments pertinent to wetland and riparian areas included those addressing soil resources, water resources and quality, and vegetation (see the Soil Resources, Water Resources and Quality, and Vegetation sections).

A few comments were specific to wetlands and riparian areas, including one that noted the importance of using aminopyralid in riparian areas to control invasive plants, and one concerned with residual effects of aminopyralid in vegetation in wetland and riparian areas.

Factors that Influence the Fate, Transport, and Persistence of Herbicides in Wetland and Riparian Areas

If applied directly to wetlands and riparian areas, herbicides dissipate by transport through water or wind, through chemical or biological degradation, or through adsorption and immobilization in soils. Wetlands and riparian areas adjacent to herbicide treatment sites can help filter herbicides from runoff through physical, chemical, and biological processes (Mitch and Gosselink 2000). Factors that influence herbicide fate in wetlands include the amount and type of vegetation, the amount of organic matter in the soil, oxygen availability, and populations of soil microbes (Stoeckel et al. 1997).

Saturated wetland soils have chemical and biological characteristics that are different from well-drained upland soils, including oxidation-reduction status, pH, and organic content. The characteristics of wetland soils affect their capacity to adsorb, transport, and transform herbicides. The fate of herbicides in wetland soils is dependent on the duration of saturation, soil temperature, the kind and amount of organic matter, and the nature and content of reactive chemicals present in the soil.

The rate of breakdown in anaerobic systems can be estimated by the measured anaerobic half-life (Table 4-6). With the exception of fluroxypyr, anaerobic degradation processes are typically slower than the degradation processes in well-drained soils where oxygen is present. However, the soil type and other environmental conditions are also important factors.

TABLE 4-6
Anaerobic Half-life in Soil for Herbicides Analyzed in this PEIS

Herbicide	Anaerobic Soil Half-life (days)	Aerobic Soil Half-life (days)
Aminopyralid	462-990	32-533
Fluroxypyr	3.5-14	7-23
Rimsulfuron	18	5 to 40
Sources: USEPA 2005c, NYSDEC 2009, U.S. National Library of Medicine 2011.		

Methodology for Assessing Impacts to Wetland and Riparian Areas

The BLM reviewed the literature and findings from ERAs to assess the impacts to aquatic plant species from the use of herbicides (AECOM 2014a,b; AECOM 2015). The ERA methods and results for aquatic and terrestrial vegetation are summarized in the Vegetation section of this chapter. Methods used by the BLM are presented in detail in the *Vegetation Treatments Programmatic EIS Ecological Risk Assessment Protocol* (ENSR 2004).

The analysis of impacts to wetland and riparian areas assumes that the BLM would follow applicable SOPs identified in the 2007 PEIS:

- Survey for special status aquatic and riparian plant species before treating an area, at a time when the plants can be identified.

- Use drift reduction agents to reduce the risk of drift hazard.

- Use a selective herbicide and a wick or backpack sprayer.

- Use an appropriate herbicide-free buffer zone for herbicides not labeled for aquatic use. This information is discussed in the ERA guidance provided in the Vegetation section of this chapter. Minimum buffer widths for herbicides not labeled for aquatic use are 100 feet for aerial, 25 feet for vehicle, and 10 feet for hand applications (larger buffers may be required if special status species are present).

Other SOPs would help minimize the risk of a spill into wetland habitats, including preparing a spill contingency plan in advance of treatments, mixing and loading herbicide products in an area where an accidental spill would not reach a water body, not rinsing spray tanks in or near water bodies, following product labels for use and storage, and having licensed applicators apply the herbicides.

Summary of Herbicide Impacts

None of the three active ingredients proposed for use are currently approved for direct aquatic applications. Therefore, the BLM's minimum buffers would apply, unless ERAs indicate larger buffers are warranted, or project-specific NEPA analysis indicates that a smaller buffer is appropriate. Aminopyralid, fluroxypyr, and rimsulfuron can be applied in dry riparian areas, non-irrigation ditch banks, seasonally dry wetlands, and transitional areas between upland and lowland sites. Additionally, if aminopyralid receives an aquatic registration in the future, the buffers associated with its use near aquatic habitats could be reduced.

Based on the likely usage of the three active ingredients, wide-scale removal of riparian vegetation would not occur. Fluroxypyr and rimsulfuron would not typically be used near water, except possibly for spot treatments of certain target species. However, aminopyralid would be used in riparian treatments for selective removal of certain species (e.g., knapweeds), although extensive removal of riparian vegetation would be unlikely. If aminopyralid receives an aquatic registration in the future, reduced buffers near aquatic habitats would allow its use in targeting a variety of wetland and riparian species, such as purple loosestrife, Japanese knotweed, and saltcedar. In riparian areas and wetlands, aminopyralid would potentially provide an alternative to glyphosate, which is less selective and more likely to result in removal of non-target riparian and wetland vegetation.

A general discussion of impacts to wetlands and riparian areas from use of herbicides to control aquatic and riparian vegetation is provided in the 2007 PEIS (USDOI BLM 2007a:4-37 to 4-38). Herbicide treatments can improve habitat quality for fish and wildlife, improve hydrologic function, and reduce soil erosion. Herbicide treatments would focus on non-native species that displace native vegetation and that alter wildlife habitat, hydrology and soil conditions. Many of the species targeted for control (such as purple loosestrife, reed canarygrass, and saltcedar) form dense monocultures that shade out native species and reduce wetland functions. Management of these species would be expected to increase the functions and values of treated wetlands and riparian areas.

While loss of vegetation could lead to short-term impacts such as increased sedimentation and nutrient loading, and alteration of vegetation, water temperature, and hydrologic conditions, it is expected that these short-term impacts would be minimal given that extensive removal of riparian vegetation would be unlikely.

A general discussion of the impacts to wetlands and riparian areas from the use of herbicides in upland areas is provided in the 2007 PEIS (USDOI 2007a:4-40). Non-target wetland and riparian areas could be exposed to herbicides transported from upland areas via a variety of methods. The primary potential impacts would be loss of non-target native vegetation and contamination of water or soil, particularly as a result of an accidental spill.

Aminopyralid

As discussed previously, aminopyralid could be used in dry wetlands and riparian areas. Therefore, any herbicide that remains adsorbed to soil particles could be released into the water if these areas become flooded or saturated following the treatments. Additionally, if aminopyralid receives an aquatic registration, it could be used in saturated conditions, and could enter the water directly as a result of incidental overspray.

Aminopyralid does not have activity on submerged aquatic species, such as watermilfoil and water-thyme, and would not be applied directly to the water column to treat unwanted aquatic vegetation. However, it may be effective at controlling riparian invasives. Field research trials support use of aminopyralid to manage emerged shoreline invasive species (e.g., purple loosestrife, Japanese knotweed, and invasive thistle species; Peterson et al. 2013).

Aminopyralid is effective against many invasive herbaceous broadleaf weeds, and may offer improvements in control of Russian olive and saltcedar. One study found that adding aminopyralid to triclopyr increased its control of these species without injuring desirable understory grass vegetation (Sluegh et al. 2011).

Aminopyralid has a photodegradation half-life of 0.6 days in aquatic systems (USEPA 2005c). In anaerobic systems, however, the active ingredient is persistent, with a half-life between 462 and 990 days (USEPA 2005c). The half-life in sediment is 999 days (Yoder and Smith 2002).

As described in the ERA for aminopyralid, non-target aquatic plants are not at risk for adverse effects from exposure to aminopyralid, even under direct spray and worst-case spill scenarios. However, non-aquatic plants (including riparian species and emergent wetland plants) would be at risk for adverse effects if a broadcast spray treatment were to occur near wetland and riparian habitats. Use of adequate buffers would be required to prevent adverse effects to sensitive riparian and wetland habitats under broadcast spray scenarios. These buffers are discussed in more detail in the Vegetation section (see Table 4-8).

Fluroxypyr

As discussed previously, fluroxypyr would have minimal use in wetland and riparian habitats, except for spot treatments of certain target species. It is not approved for use in aquatic habitats or wetlands when water is present. Therefore the amount of this active ingredient that is likely to be released to wetland and riparian areas under normal application scenarios is very small. Accidental spills or movement from adjacent upland areas could result in more of the active ingredient entering wetland or riparian habitats.

Fluroxypyr is short-lived in anaerobic environments. In anaerobic soil the half-life is 14 days or less (National Library of Medicine 2011). In anaerobic aquatic habitats, the half-life is 8 days (USEPA 1998a). The breakdown products may persist for longer.

As described in the ERA for fluroxypyr, non-target aquatic plants are not at risk for adverse effects from fluroxypyr under direct spray or surface runoff scenarios. However, they would likely be harmed by an accidental spill of fluroxypyr into a pond or stream in which they occur. The risks of such a spill occurring would be reduced by applicable SOPs, as discussed earlier in this Wetland and Riparian Areas section. Non-aquatic plant species in wetlands and riparian areas would be at risk for adverse effects from spray drift at nearby upland habitats. Suitable buffers would be required to prevent adverse effects to non-target plants in sensitive riparian and wetland habitats. See Table 4-8 and the Vegetation section for more information on buffers.

Algal growth may be stimulated at low fluroxypyr concentrations but depressed at higher concentrations (Zhang et al. 2011).

Rimsulfuron

As discussed previously, rimsulfuron is not likely to be used much in or near wetland and riparian areas, except for spot treatments of certain target species. Similar to fluroxypyr, only small amounts of this chemical are likely to enter wetland and riparian areas under normal application scenarios, although larger amounts could enter these habitats as a result of an accidental spill or movement from an adjacent treatment site.

Rimsulfuron has a high rate of soil adsorption in soils with high organic content (Metzger et al. 1998). However, it is quickly degraded under anaerobic conditions. In anaerobic soil the half-life is approximately 18 days. In anaerobic aquatic habitats, the half-life is less than 2 days (NYSDEC 2009). Breakdown products may persist for longer.

According to the ERA, rimsulfuron poses a risk to non-target aquatic plants under direct spray, accidental spill, spray drift, and certain surface runoff scenarios. Risks associated with surface runoff would be limited to aquatic plants in ponds, and would be greatest in areas with 50 inches of precipitation or more per year. Non-aquatic plants, such as riparian and emergent wetland species would also be at risk for adverse effects from treatments in nearby upland areas. These findings indicate that buffers are needed between treatment sites and wetlands/riparian areas to protect vegetation from unintended harm. These buffers are discussed in more detail in the Vegetation section and Table 4-8.

Impacts by Alternative

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under the No Action Alternative, the BLM would continue its ongoing vegetation management programs in 17 western states, and would be able to use the current list of 18 approved herbicides for treatments. Impacts under this alternative would correspond to those discussed under the Preferred Alternative in the 2007 PEIS (USDOI BLM 2007a:4-42). The total area receiving herbicide treatments would be 932,000 acres annually, of which approximately 10,000 acres would consist of aquatic and riparian habitat. Herbicides used to manage aquatic and riparian vegetation under this alternative could include 2,4-D, diquat, fluridone, glyphosate, and imazapyr, which are registered for aquatic uses; and dicamba, tebuthiuron, and triclopyr in riparian areas where contact with water can be avoided.

Use of the currently approved herbicides would be associated with both beneficial and adverse effects to wetlands and riparian areas. There would be some risk for contamination of water and/or soils in these habitats as a result of herbicide applications or spills, as well as risks to non-target plant species from exposure to herbicides via various pathways.

Herbicide treatments that target invasive riparian and wetland plant species would be expected to benefit these habitats by promoting the reestablishment of native species and improving the functions provided by the targeted wetlands and riparian areas. The BLM would be able to control targeted invasive species (such as Eurasian water milfoil, water-thyme, purple loosestrife, and saltcedar) with the suite of herbicides available for use.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, the estimated area of wetland and riparian areas receiving herbicide treatments annually would be the same as under the No Action Alternative and the other action alternatives. However, aminopyralid, fluroxypyr, and rimsulfuron would be added to the list of herbicides available for use. Because none of the new active ingredients would be registered for direct applications to the water column, they would not be used to control invasive aquatic species. 2,4-D, diquat, fluridone, glyphosate, and imazapyr would continue to be used for these aquatic applications.

While fluroxypyr and rimsulfuron would receive minor use in wetland and riparian habitats, aminopyralid would be an important component of riparian and wetland treatments, particularly if it receives an aquatic registration allowing incidental overspray into wetlands and aquatic habitats. The BLM has identified aminopyralid as a good alternative to glyphosate that is more selective and therefore less likely to harm target vegetation, and may be less of a concern in terms of persistence in groundwater and aquatic habitats (see the Water Resources and Quality section). However, aminopyralid persists much longer than glyphosate in anaerobic, wetland soils (462 to 990 days, versus 12 to 70 days for glyphosate). Therefore, use of aminopyralid in and near wetland habitats may have a greater impact than glyphosate from an environmental persistence standpoint. Under this alternative, it is expected that use of glyphosate would be reduced, relative to the No Action Alternative. It is likely that the BLM would use aminopyralid to target knapweeds in riparian areas, as well as for other broadleaf invasive species.

The addition of fluroxypyr and rimsulfuron may also reduce the usage of some other herbicides in wetland and riparian areas, but not to a substantial degree.

Alternative C – No Aerial Application of New Herbicides

Alternative C is similar to the Preferred Alternative in that the same herbicides would be available for use, and the total area of wetland and riparian areas treated would be approximately 10,000 acres. As discussed in the 2007 PEIS (USDOI BLM 2007a:4-43), nearly all of the herbicide treatments in wetland and riparian areas are done using ground-based methods. Additionally, aerial applications of upland areas would be completed using the currently approved herbicides, so risks to wetlands and riparian areas from spray drift would be much the same as under the other alternatives, although different herbicides may be used than under Alternatives B and D.

Benefits and risks to wetland and riparian areas would be much the same as under the Preferred Alternative. For ground-based treatments in wetlands and riparian areas, aminopyralid would likely be used instead of glyphosate in certain situations.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Effects to wetlands and riparian areas under Alternative D would be much the same as those under the Preferred Alternative. Rimsulfuron would not be available for use under Alternative D. However, since rimsulfuron would receive minimal use near wetlands and in riparian areas, there would be little difference in herbicide usage in these areas relative to the other alternatives. Aminopyralid would be used instead of glyphosate for certain treatments in and near wetlands and riparian areas, similar to the other action alternatives. Benefits and risks to wetland and riparian areas would also be much the same as under the other action alternatives.

Mitigation for Herbicide Treatment Impacts

No mitigation measures have been developed that are specific to wetlands and riparian areas. The BLM's SOPs to protect water resources and vegetation would also help protect riparian and wetland habitats. Additionally, mitigation measures for vegetation, specified in the next section, would help protect riparian and wetland habitats. These include utilizing adequate buffer zones between sensitive non-target vegetation and herbicide treatment areas, which in many cases would be applicable to riparian and wetland vegetation.

Vegetation

Introduction

The present-day composition and distribution of native plant communities in the western U.S. are influenced by many factors, including physical factors (e.g., climate, drought, wind, geology, topography, elevation, latitude, slope, and exposure), natural disturbance (e.g., insects, disease, fire, and wildlife browsing), and human-management patterns (e.g., domestic livestock grazing). Non-native plant species have caused a decline in the extent of some native plant communities in each of the western states. The rapid expansion of invasive plant species across public lands continues to be a primary cause of ecosystem degradation, and control of these species is one of the greatest challenges in ecosystem management. The recent increase in wildfires has been influenced by changes in vegetation on public lands over the past 100 years, which have resulted in increases in hazardous fuels. Cheatgrass, which is widespread on public lands, burns more frequently than native vegetation types and is disproportionately represented in the largest fires, indicating that invasion of this species has substantially altered fire regimes (Balch et al. 2013).

Scoping Comments and Other Issues Evaluated in the Assessment

Numerous scoping comments received by the BLM pertain to vegetation, addressing both the beneficial effects associated with use of the three new herbicides to control weeds, and the potential adverse effects to non-target vegetation. Most comments discuss the efficacy and low impact of the herbicides proposed for use, and their low impact to native plant species relative to other herbicides that are currently being used by the BLM. Specifically, numerous comments identified the efficacy of rimsulfuron at controlling cheatgrass and medusahead rye, the efficacy of aminopyralid as a control of knapweed, thistles, and rush skeletonweed, and the efficacy of fluroxypyr on kochia.

Several comments were concerned about the effects to non-target vegetation from residual aminopyralid or fluroxypyr in manure and compost and other plant materials. One comment addressed the importance of reseeding of desirable species after treatments to promote recovery of native plant communities following herbicide treatments.

Standard Operating Procedures

Risks to non-target plants associated with herbicide use would continue to be minimized by following the SOPs listed in the 2007 PEIS, which are general procedures designed by the BLM to reduce potential unintended impacts to non-target vegetation from herbicide treatments. Examples of pertinent SOPs (with slight modifications since 2007) include the following:

- Conduct pre-treatment surveys for sensitive habitat and special status species within or adjacent to proposed treatment areas, at a time when the plants can be found.
- Consider site characteristics, environmental conditions, and application equipment in order to minimize damage to non-target vegetation.
- Use drift reduction agents, as appropriate, to reduce the drift hazard to non-target species, and colorants to obtain a uniform coverage.

- Turn off aerially applied treatments at the completion of spray runs and during turns to start another spray run.

- Refer to the herbicide label when planning revegetation to ensure that subsequent vegetation will not be injured following application of the herbicide.

Additionally, the BLM would follow the mitigation measures that were adopted in the 2007 ROD (USDOI BLM 2007b: Table 2) for vegetation treatments involving the 18 currently approved herbicides. These mitigation measures include establishing herbicide-specific buffer zones, limiting aerial applications of certain active ingredients, and minimizing the use of terrestrial herbicides in watersheds with downgradient ponds and streams if potential impacts to aquatic plants are identified. Some of these measures would apply to treatments involving the three new active ingredients, including tank mixes that include the currently approved herbicides for which specific mitigation measures have been developed.

These procedures would minimize impacts to plants and ecosystems on public lands from use of the new active ingredients to the extent practical. Long-term benefits to native plant communities from management of invasive plants would likely continue to outweigh any short-term negative impacts to native plants associated with herbicide use.

Impacts Assessment Methodology

The method of assessing impacts to non-target vegetation from the three new herbicides was the same as the method described in the 2007 PEIS (USDOI BLM 2007a:4-45 to 4-46; Appendix C) for herbicides with BLM ERAs. A brief overview of the ERA process is presented here. Additionally, information about likely future herbicide treatments, provided by local field offices for development of the 2007 PEIS, was assumed to be applicable to the alternatives in this PEIS. This information includes the location, application method, vegetation type, and size of the treatment (in acres).

Risk Assessment Methodology

Risk assessments evaluated the risks to terrestrial and aquatic non-target plants from herbicide exposure. Risk assessments consider assessment endpoints and associated measures of effect. The assessment endpoint is an expression of the value that is to be protected. In the case of non-target plants, assessment endpoints include mortality and negative impacts on growth, reproduction, or other ecologically important sublethal processes. For the most part, assessment endpoints reflect direct effects of the herbicide, although indirect effects were also considered.

Measures of effect are measurable changes in an attribute of an assessment endpoint (or its surrogate) in response to a stressor to which it is exposed (USEPA 1998b). For the ERAs, these measures generally consisted of acute and chronic toxicity data (from pesticide registration documents and from the available scientific literature) for the most appropriate surrogate species.

Because the BLM applies herbicides in a variety of sites using a variety of application methods (e.g., via aircraft, vehicle, and backpack), the following exposure scenarios were considered to assess the potential ecological impacts of herbicides under a variety of uses and conditions:

- Direct spray of the receptor.

- Off-site drift of spray to terrestrial areas and water bodies.

- Surface runoff from the application area to off-site soils or water bodies.

- Wind erosion resulting in deposition of contaminated dust.

- Accidental spills to water bodies.

The AgDRIFT computer model was used to estimate off-site herbicide transport due to spray drift. The Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) computer model was used to estimate off-site transport of herbicide in surface runoff and root zone groundwater transport. The AERMOD and CALPUFF computer models were used to predict the transport and deposition of herbicides adsorbed (i.e., reversibly or temporarily attached) to wind-blown dust. Each model simulation was conservatively approached with the intent of predicting the maximum potential herbicide concentration that could result from the given exposure scenario.

In order to address potential risks to plant receptors, Risk Quotients (RQs) were calculated. To help translate RQs into estimates of risk, the calculated RQs were compared with Levels of Concern (LOCs) used by the USEPA in screening the potential risk of herbicides. For plants, distinct USEPA LOCs are currently defined for the following risk categories:

- Acute high risk – the potential for acute risk is high.
- Acute endangered species – threatened, endangered, and proposed species may be adversely affected.

For the analysis presented in this PEIS, the LOC for acute high risk (1) was used for typical terrestrial and aquatic plant species. Wherever the RQ exceeded the LOCs, it was assumed that acute adverse effects to non-target plant species could potentially occur under that exposure scenario. The methodology for determining risks to special status plant species is discussed later in this section, under the Special Status Plant Species subheading.

Summary of Herbicide Impacts

Under all alternatives, treatments involving the new herbicides would be one component of the BLM's larger vegetation management programs, which have been discussed in more detail in the 2007 PEIS and PER. As discussed in the 2007 PEIS (UDSI BLM 2007a:4-47), the effectiveness of herbicide treatments in managing target plants and the extent of disturbance to plant communities varies by the herbicide selectivity, the extent and density of the infestation, the size of the application area, and the application method (e.g., aerial vs. ground). Individual plant sensitivities, physical features (e.g., soil type and slope), and weather conditions (e.g., temperature, humidity, and wind speed) at the time of application also factor into the success of a treatment. Additionally, other treatments or herbicides used in conjunction with treatments involving aminopyralid, fluroxypyr, and rimsulfuron would influence the effectiveness of the overall treatment.

Herbicide treatments would likely affect the plant species composition of an area and might affect plant species diversity. The discussions in this section focus on the impacts of the three new herbicides on vegetation (both target and non-target species). General discussions about the impacts of herbicide treatments on vegetation can be found in the 2007 PEIS (USDOI BLM 2007a:4-47 to 4-48). For treatments involving one or more of the three new herbicides, active ingredients that adversely affect plants could come into contact with vegetation via direct spraying, drift, runoff, wind transport, or accidental spills. Potential impacts include mortality, reduced productivity, and abnormal growth. These exposure pathways and associated risks to non-target plants were evaluated in risk assessments for the three herbicides (AECOM 2014a,b; AECOM 2015).

Impacts of Aminopyralid

Target Plants

Aminopyralid is a post-emergence, selective herbicide that is used to manage invasive annual, biennial, and perennial species. It is a plant growth regulator that binds to receptor sites normally used by the plant's natural growth hormones, causing death of the plant. Anecdotal evidence and controlled studies of aminopyralid have found it to be effective at controlling yellow starthistle, Russian knapweed, various thistles, rush skeletonweed, and other invasive plants of rangelands (DiTomaso and Kyser 2006; Enloe et al. 2008; Bell et al. 2012). Other species controlled by aminopyralid include oxeye daisy, Mediterranean sage, and Japanese and other large knotweeds (DiTomaso et al. 2013). The BLM has identified this herbicide for its activity on difficult-to-control species in rangelands, among other uses. It is an alternative to other growth regulator herbicides that are commonly used on broadleaf weeds, such as picloram, clopyralid, 2,4-D, and dicamba. Studies have also found aminopyralid to be as or more effective than the currently approved growth regulator herbicides at lower application rates (Enloe et al. 2007, 2008; Bell et al. 2012). Aminopyralid has a higher specific activity than other growth regulator herbicides, so less of it needs to be used to achieve the same result (Iowa State University 2006). In mixtures with other active ingredients, it can be used on hard-to-control species like poison hemlock and catsears (DiTomaso et al. 2013).

There is some evidence that aminopyralid may be effective against certain annual grasses when applied at higher application rates pre- or early post-emergence (DiTomaso 2012). At sites representative of annual grasslands in California, it has been shown to control medusahead rye and result in increased cover of more desirable annual forage species, and may also have utility in suppressing cheatgrass (DiTomaso 2012). Additionally, aminopyralid may have a sterilizing effect on annual grasses, and appears to reduce seed production in cheatgrass (Rinella et al. 2013).

Non-Target Plants

Because aminopyralid is used to manage weedy broadleaf species, it poses a risk to non-target native forbs and other desirable species in treatment areas. Generally speaking, it is a selective herbicide, falling between picloram and clopyralid in terms of selectivity (Iowa State University 2006). Studies with aminopyralid indicate that some native species are more tolerant to aminopyralid than others (Mikkelson and Lym 2013), indicating that the native species composition of treatment sites could be altered by the use of aminopyralid. Based on its documented control of invasive plants, key flowering plant families that are affected by aminopyralid include the Asteraceae (aster), Fabaceae (legume), and Polygonaceae (buckwheat) families. Additionally, the timing of a treatment may influence which native species will be most tolerant to aminopyralid (Halstvedt et al. 2011). In general, this herbicide is likely to select for perennial grass species and more resistant forb species. However, there is also evidence that use of aminopyralid causes an overall increase in the relative cover and dominance of native species (Green et al. 2011). Reduction in cover of non-native species and an increase in native species would have a long-term beneficial effect at treatment sites.

One study documented adverse effects to forest communities from use of aminopyralid. Aminopyralid treatments in ponderosa pine stands (trees 5 to 10 years old, at higher rates than those proposed by the BLM) can result in injury to ponderosa pine trees, leading to decreased canopy volume and variable growth patterns (Wallace et al. 2012).

As stated on the herbicide label, aminopyralid may impact non-target broadleaf plants indirectly if urine or manure from animals that graze on treated pasture within 3 days of the herbicide application comes into contact with these plants (Iowa State University 2006). Aminopyralid is persistent in plant materials, and may remain in undigested remains of treated vegetation for more than 2 years (Oregon State University 2009, Dow AgroSciences 2014). This persistence in plant materials is generally a concern for crops and other plantings that are treated with compost that contains plant residues or hay or straw from treated areas. However, it is possible that some localized impacts to non-target native plants could occur if livestock or wildlife graze in treated areas and then release their waste materials on desirable broadleaf native species.

The risk assessment for aminopyralid indicates that aminopyralid poses a high risk to non-target plants within the treatment area. As shown in Table 4-7, risks for adverse effects to terrestrial plants would be high if there was direct exposure to aminopyralid as a result of a direct spray (as part of a treatment or accidental) or an accidental spill. Therefore, it is likely that some non-target broadleaf species would be adversely affected if they are present in the treatment area. For non-target aquatic plants, however, ERAs predicted no risk under direct spray or spill scenarios. Aminopyralid is not approved for aquatic uses, but is likely to receive a registration that addresses incidental overspray into aquatic habitats. These risk assessment results indicate that use indicate that use of aminopyralid right up to the water's edge would not harm aquatic plants.

Apart from direct spray scenarios, risks to terrestrial plants would generally be low. Risks associated with off-site drift decrease as the distance from the treatment site increases and the application height gets lower (plane to helicopter to high boom to low boom). The buffer widths shown in Table 4-8 indicate the distances within which adverse effects to non-target terrestrial plants would be expected to occur for the various application scenarios. For aerial applications, buffer distances range from 1,200 to 1,800 feet, depending on the application rate and type of aircraft used. Buffer distances for ground applications are much lower, ranging from 25 to 400 feet.

For surface runoff and root-zone groundwater flow scenarios, no risks to non-target terrestrial or aquatic plants were predicted. The GLEAMS model used to complete this portion of the risk assessments considered a variety of soil types and annual precipitation rates.

For wind erosion scenarios, no risks were predicted for non-target terrestrial plants under the majority of the evaluated conditions. Low risk was predicted for one of the modeled watersheds, with affected plants at a distance of 1.5 kilometers (0.9 mile) from the original application site. The modeled watershed was Medford, Oregon, a forested site with loam soils, where the presence of tall vegetation caused the model to predict relatively high rates of deposition.

Impacts of Fluroxypyr

Target Plants

Fluroxypyr is a selective, post-emergent herbicide that is used to manage broadleaf species in rangelands and other areas (see Table 2-2). It is in the pyridine class of herbicides, and disrupts plant cell growth by inducing auxin-like responses. It is often used in industrial sites, along roads and railroads, and along ROWs. Based on its documented control of weeds, key flowering plant

TABLE 4-7
Risk Categories Used to Describe Typical Herbicide Effects to Vegetation According to Exposure Scenario and Ecological Receptor Group

Application Scenario	Aminopyralid		Fluroxypyr		Rimsulfuron	
	Typ[1]	Max[1]	Typ	Max	Typ	Max
Direct Spray/Spill						
Terrestrial plants	**H**[2] [1:1]	**H** [1:1]	**H** [1:1]	**H** [1:1]	**H** [1:1]	**H** [1:1]
Special status terrestrial plants	**H** [1:1]	**H** [1:1]	**H** [1:1]	**H** [1:1]	**H** [1:1]	**H** [1:1]
Aquatic plants pond	0 [2:2]	0 [4:4]	0 [2:2]	**L** [2:4]	**H** [1:2]	**M** [2:4]
Aquatic plants stream	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]	**H** [1:2]	**H** [1:2]
Off-Site Drift						
Terrestrial plants	**L** [10:18]	**L** [10:18]	**L** [11:18]	**L** [11:18]	**L** [9:18]	**L** [9:18]
Special status terrestrial plants	**L** [10:18]	**L** [10:18]	**L** [13:18]	**L** [11:18]	**L** [9:18]	**L** [8:18]
Aquatic plants pond	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [24:36]	0 [23:36]
Aquatic plants stream	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [24:36]	0 [23:36]
Surface Runoff						
Terrestrial plants	0 [42:42]	0 [42:42]	0 [42:42]	0 [42:42]	0 [42:42]	0 [42:42]
Special status terrestrial plants	0 [42:42]	0 [42:42]	0 [42:42]	0 [42:42]	0 [42:42]	0 [42:42]
Aquatic plants pond	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [55:84]	0 [54:84]
Aquatic plants stream	0 [84:84]	0 [84:84]	0 [80:84]	0 [84:84]	0 [84:84]	0 [84:84]
Wind Erosion						
Terrestrial Plants	0 [9:9]	0 [8:9]	0 [9:9]	0 [8:9]	0 [8:9]	0 [8:9]
Special status terrestrial plants	0 [8:9]	0 [8:9]	0 [8:9]	0 [7:9]	0 [8:9]	0 [8:9]

[1] Typ = Typical application rate; and Max = Maximum application rate.

[2] Risk categories: 0 = No risk (majority of RQs < applicable LOC); L = Low risk (majority of RQs 1-10 times the applicable LOC); M = Moderate risk (majority of RQs 10-100 times the applicable LOC); and H = High risk (majority of RQs >100 times the applicable LOC). The Risk Category is based on the risk level of the majority of risk quotients observed in any of the scenarios for a given exposure group and receptor type. For some "no risk" exposure groups, RQs for one or more scenarios exceeded the applicable LOC. The reader should consult the risk tables in Chapter 4 of the ERAs (AECOM 2014a,b; AECOM 2015) to determine the specific scenarios that result in the displayed level of risk for a given receptor group. The number in brackets represents the number of RQs in the indicated risk category: number of scenarios evaluated.

TABLE 4-8
Buffer Distances to Minimize Risk to Non-target Vegetation from Off-site Drift

Application Scenario	Aminopyralid	Fluroxypyr	Rimsulfuron
Buffer Distance (feet) from Non-Target Terrestrial Plants			
Typical Application Rate			
Plane[1]	1,300 feet	1,200 feet	1,600 feet
Helicopter[1]	1,200 feet	900 feet	1,400 feet
High Boom[2]	200 feet	400 feet	400 feet
Low Boom[2]	25 feet	100 feet	100 feet
Maximum Application Rate			
Plane	1,800 feet	1,500 feet	1,900 feet
Helicopter	1,600 feet	1,400 feet	1,600 feet
High Boom	400 feet	600 feet	700 feet
Low Boom	100 feet	400 feet	400 feet
Buffer Distance (feet) from Terrestrial Threatened, Endangered, and Sensitive Plants			
Typical Application Rate			
Plane	1,800 feet	1,200 feet	1,600 feet
Helicopter	1,600 feet	900 feet	1,400 feet
High Boom	400 feet	400 feet	400 feet
Low Boom	100 feet	100 feet	100 feet
Maximum Application Rate			
Plane	2,000 feet	1,500 feet	1,900 feet
Helicopter	1,700 feet	1,500 feet	1,600 feet
High Boom	600 feet	700 feet	700 feet
Low Boom	400 feet	600 feet	400 feet
Buffer Distance (feet) from Non-Target Aquatic Plants[3]			
Typical Application Rate			
Plane	NA[4]	NA	1,300 feet
Helicopter	NA	NA	1,000 feet
High Boom	NA	NA	200 feet
Low Boom	NA	NA	100 feet
Maximum Application Rate			
Plane	NA	NA	1,400 feet
Helicopter	NA	NA	1,800 feet
High Boom	NA	NA	300 feet
Low Boom	NA	NA	100 feet

[1] Aerial applications over both forested and non-forested land were considered in the ERAs. The largest buffer distances are presented in this table.
[2] High boom is 50 inches above ground and low boom is 20 inches above ground.
[3] Aquatic plants in ponds and streams were considered in the ERAs. The largest buffer distances are presented in this table.
[4] NA means that no buffers are required, since direct spray of plants was not predicted to result in adverse effects. However, a direct spray into an aquatic habitat is not an approved use of these herbicides.
Buffer distances are the smallest modeled distance at which no risk was predicted. In some cases, buffer distances were extrapolated if the largest distance modeled still resulted in risk, or interpolated if greater precision was required.

families that are affected by fluroxypyr include the Asteraceae (aster), and Fabaceae (legume) families.

The BLM has identified the effectiveness of this herbicide on annual and biennial weeds, particularly when tank-mixed with another herbicide such as 2,4-D, dicamba, metsulfuron methyl, or triclopyr. It would be used to manage species such as weedy (annual) kochia, mustards, pricklypear, ragweed, leafy spurge, and invasive blackberry. Fluroxypyr has been shown to have a synergistic effect when mixed with 2,4-D to control certain broadleaf weeds (Smith and Mitra 2006), and to improve control of leafy spurge when mixed with picloram (Peterson 1989). Fluroxypyr mixed with picloram has also been shown to control cholla and pricklypear, which can become dense on desert grassland sites as a result of overgrazing (Cummings and Duncan 2009).

Fluroxypyr has been identified as an option for addressing weeds that are resistant to herbicides with different modes of action. Its uses would likely include oil and gas sites where resistance to currently approved herbicides could be a problem. For instance, kochia that is resistant to ALS-inhibiting herbicides can be treated with fluroxypyr, although kochia can also develop a resistance to fluroxypyr (Montana State University Extension 2011).

Non-Target Plants

Fluroxypyr is a selective herbicide that controls broadleaf species. Therefore it poses a risk to non-target forbs, as well as desirable woody species in treatment areas. Because fluroxypyr is often tank-mixed with other active ingredients, its risk for non-target effects should be considered in conjunction with those of the other active ingredients.

Fluroxypyr would be used at oil and gas sites or other locations where complete removal of vegetation is desired. In these situations, non-target plants would not be present within the treatment area.

The risk assessment for fluroxypyr indicates that this active ingredient poses a high risk to non-target terrestrial plants through direct spray scenarios (Table 4-7). It is assumed that direct spray of some non-target vegetation within the treatment area (if present) would occur, particularly if fluroxypyr is broadcast sprayed over a large area where desirable broadleaf species are present and are susceptible at the time of treatment.

In the case of aquatic habitats, direct spray into a pond or a stream would not pose a risk to non-target aquatic plant species. Therefore, standard buffers between treatment areas and aquatic habitats would be sufficient to prevent harm to aquatic plants. However, an accidental spill of a large quantity of fluroxypyr (i.e., an entire load of herbicide mixed for an application) into a pond would pose a risk to non-target aquatic plants. These risks would be minimized by SOPs, which include conducting mixing and loading operations in areas where an accidental spill would not contaminate aquatic habitats.

Risks to terrestrial plants from off-site drift are generally low, and would be greatest for aerial applications of fluroxypyr. Suitable buffer distances to protect non-target terrestrial plants range from 100 feet for ground applications with a low boom to 1,500 feet for certain airplane applications (Table 4-8). No risks to terrestrial plants were predicted for surface runoff exposure scenarios.

No risks to non-target aquatic plants were predicted for exposures involving off-site drift, surface runoff, or root-zone groundwater flow under a variety of site conditions.

For wind erosion scenarios, no risks were predicted for non-target terrestrial plants under the majority of the evaluated conditions. Low risk was predicted for the Medford, Oregon modeled watershed, with affected plants at a distance of 1.5 km from the original application site.

Additional effects to certain non-target plant species could occur if populations of pollinators were harmed by herbicide spraying. Based on ERAs, fluroxypyr poses a low risk to pollinators under direct spray scenarios. However, ERAs did not identify risks to pollinators from use of aminopyralid or rimsulfuron.

Impacts of Rimsulfuron

Target Plants

Rimsulfuron is a selective, ALS-inhibiting herbicide that controls target weeds by inhibiting the biosynthesis of certain amino acids. It is applied both pre- and post-emergence, and is active in both the xylem and the phloem of the plant. Invasive plants targeted by this active ingredient include cheatgrass, medusahead rye, and other annual grasses that have invaded public lands in the western U.S. The BLM is proposing to use this active ingredient extensively, based on reports that it is effective at controlling winter annual grasses.

Rimsulfuron is effective against cheatgrass and Japanese brome in the fall pre-emergence, or post emergence in the fall or spring. It provides a longer window of control than imazapic, although it must be used at the highest label rates for effective spring applications. Rimsulfuron can also be used to control larger cheatgrass plants than imazapic (Beck, No date).

The effectiveness of rimsulfuron at controlling cheatgrass and medusahead rye has been documented (Zhang et al. 2010), although there is conflicting evidence about its effectiveness relative to currently approved active ingredients (primarily imazapic). Some studies with rimsulfuron indicate that it is not as effective at controlling cheatgrass as either of the currently approved herbicides imazapic or sulfometuron methyl (Clements and Harmon 2013). However, there is also evidence that rimsulfuron is more effective than imazapic under certain conditions (Hirsch et al. 2012).

Non-Target Plants

Rimsulfuron is a selective herbicide that targets annual grasses and other annual species. Therefore, it has minimal effects on perennial grasses and other desirable perennial species. A study in northeastern California rangelands found that rimsulfuron effectively controlled cheatgrass and medusahead rye without substantially impacting sagebrush and desirable perennial grasses such as squirreltail (Zhang et al. 2010). Additionally, there is some evidence that application of rimsulfuron can result in an increase in perennial grass cover at treatment sites, compared to no discernable effect by imazapic (Hergert et al 2012). Therefore, rimsulfuron may benefit perennial non-target plant species, with less post-treatment restoration needed.

Based on information from the ERA, rimsulfuron poses a high risk to non-target terrestrial plants under direct spray scenarios (Table 4-7). Therefore, it is likely that some native plant species within the treatment area (if present) would be affected by treatments involving rimsulfuron, particularly as a result of broadcast spray applications.

An accidental direct spray of rimsulfuron into an aquatic habitat (stream or pond), or a spill of rimsulfuron into a pond, would pose a high risk for adverse effects to non-target aquatic plants. The risk of spills and accidental direct spray would be minimized through the use of SOPs.

Non-target terrestrial vegetation would be at a low risk for adverse effects from off-site drift of rimsulfuron from treatment sites. Based on ERAs, buffers of 100 to 1,900 feet (depending on the application) would be necessary to protect sensitive vegetation from adverse effects from herbicide treatments with rimsulfuron (Table 4-8).

Table 4-7 indicates that there is no risk to aquatic vegetation from off-site drift, based on information provided in the ERA. While there is some indication that chronic (long-term) exposure to rimsulfuron following off-site drift could adversely affect aquatic plants, the modeled scenarios are overly conservative because a chronic exposure is unlikely, and they do not consider flow, adsorption to particles, or degradation of the herbicide over time. The buffers presented in Table 4-8 represent the distance beyond which there would be no risk to aquatic plants under any of the modeled scenarios.

There are no predicted risks to non-target terrestrial or aquatic plants in streams as a result of surface runoff of rimsulfuron from a nearby treatment site. In the pond setting, however, chronic exposures to surface runoff of this herbicide could potentially affect aquatic plants under certain site conditions. Modeled conditions that were associated with adverse effects via surface runoff included high levels of precipitation (25 inches or more a year for sandy soils, 50 inches or more a year for loam soils, and 100 inches or more a year for clay soils).

For wind erosion scenarios, no risks were predicted for non-target terrestrial plants under the majority of the evaluated conditions. Low risk was predicted for the Medford, Oregon modeled watershed, with affected plants at a distance of 1.5 kilometers from the original application site.

Impacts of Tank Mixes and other Mixtures

Mixtures of more than one herbicide are often used to increase the efficacy of a treatment or to control a wider range of target species without requiring multiple applications. Because pre-mixes and tank mixes often include active ingredients with more than one mode of action, they can provide better control of a target species than a single active ingredient. Use of herbicide mixtures is also one strategy for avoiding and managing herbicide-resistant invasive plants (Montana State University Extension 2011). Some species targeted for control by the BLM (e.g., marestail, pigweed, and kochia) have begun to exhibit resistance to currently approved herbicides.

The ERAs for aminopyralid, fluroxypyr, and rimsulfuron did not analyze the potential effects to non-target plants from mixtures involving these herbicides. Tank mixes were discussed in Chapter 2 of this PEIS, in the section Herbicide Formulations Used by the BLM and Tank Mixes. Aminopyralid and fluroxypyr would likely be mixed with numerous other previously approved herbicides, but rimsulfuron would usually be applied on its own.

Some mixtures involving the three new active ingredients could pose a greater risk to non-target plants than treatments involving any of these herbicides alone. Certain plant species may be particularly sensitive to mixtures. Conversely, use of one of the three new herbicides in a mixture in the place of a more harmful herbicide would likely result in a reduced risk to non-target plants.

There is uncertainty associated with the use of mixtures, as the herbicides in a mixture may not interact in an additive manner; some interactions may be antagonistic and others may by synergistic. In general, buffers for the formulated product will be based on the active ingredient that requires the greatest buffer distance.

Impacts by Ecoregion

Table 4-9 provides a summary of the estimated percent of the total acres treated using herbicides within each ecoregion. The table also indicates how the treatments would be spread out among the various vegetation subclasses and macrogroups within each ecoregion. The information provided in Table 4-9 updates Table 4-16 from the 2007 PEIS to reflect the new vegetation classification system utilized by the BLM. The treatment goals and associated target geographic areas and vegetation are the same as those identified for the Preferred Alternative in the 2007 PEIS. Table 4-9 is applicable to all four of the alternatives being considered in this PEIS.

The majority (71 percent) of herbicide treatment acres would be in the Temperate Desert Ecoregion, in shrubland, grassland, and steppe macrogroups. Many treatments in these areas would have the goal of restoring fire-damaged lands in the Great Basin, improving sagebrush communities, and replacing invasive annual grasses with native bunchgrasses and forbs. Treatments may involve the management of such species as sagebrush, rabbitbrush, and other shrub species, annual grasses, and undesirable perennial forbs. Rimsulfuron would likely receive wide use in this ecoregion for managing invasive annual grasses, particularly cheatgrass and medusahead rye, in various plant community types. Aminopyralid and fluroxypyr would typically be used in tank mixes to manage broadleaf rangeland weeds such as yellow starthistle, knapweeds, and annual kochia. Treatments to manage invasive plant species can be successful with the currently approved herbicides, but the availability of the three new herbicides would allow the BLM more flexibility when designing treatments.

An additional 25 percent of herbicide treatment acres would be in the Temperate Steppe and Subtropical Steppe Ecoregions, primarily in grassland, shrubland, steppe, and chaparral macrogroups. In the Temperate Steppe ecoregion, herbicide treatments would focus on management of invasive annual and perennial grasses and forbs, including cheatgrass, leafy spurge, knapweeds, and thistles. All three of the new active ingredients could be utilized for certain identified target species. In the Subtropical Steppe Ecoregion, rimsulfuron would be a new option for managing infestations of invasive annual grasses in sagebrush and pinyon-juniper communities, and would help to reduce wildfire risk in these habitats. Similar to the Temperate Steppe Ecoregion, the three new herbicides would offer the BLM more options for meeting its treatment goals in the Subtropical Steppe Ecoregion.

Impacts by Alternative

The primary goals of herbicide treatments would be to control infestations of invasive plants and help restore natural fire regimes. Other goals might be to improve safety and protect infrastructure (e.g., controlling vegetation along roadsides or at oil and gas sites).

Herbicides would commonly be used on rangelands infested by annual grasses, such as cheatgrass and medusahead rye, followed by revegetation with perennial grasses and forbs, as needed. Herbicides would also be used to suppress or thin shrubs such as sagebrush in favor of herbaceous vegetation. In some areas, herbicide treatments might reduce the vigor or cover of perennial grasses and forbs over the short term, but perennial grass and forb communities should improve over the long term as shrub stands are thinned to allow more light and nutrients to reach the understory and competition with annual grasses and forbs is reduced. In most cases, multiple treatments and restoration would be necessary to recover native plant communities and restore natural fire regimes.

TABLE 4-9
Projected Herbicide Treatments[1], as a Percent of Total Acres Treated, in Each Ecoregion for Each Vegetation Macrogroup Under All Alternatives

Vegetation Subclass(es)[2]	Vegetation Macrogroups[2]	Ecoregion							
		Tundra	Subarctic	Marine	Mediterranean	Subtropical Desert	Subtropical Steppe	Temperate Desert	Temperate Steppe
Temperate Forest	California Forest and Woodland Californian-Vancouverian Foothill and Valley Forest and Woodland Southern Vancouverian Montane and Foothill Forest	0	0	0	82-83	0	0	0	0
	Californian-Vancouverian Foothill and Valley Forest and Woodland Vancouverian Lowland and Montane Rainforest	0	0	79	0	0	0	0	0
	Madrean Warm Montane Forest and Woodland	0	0	0	0	5	0	0	0
	Northern Rocky Mountain Lower Montane and Foothill Forest Southern Rocky Mountain Lower Montane Forest Intermountain Singleleaf Pinyon-Western Juniper Woodland Rocky Mountain Two-Needle Pinyon-Juniper Woodland	0	0	0	0	0	0	3-4	1-2
	Rocky Mountain Two-Needle Pinyon-Juniper Woodland	0	0	0	0	0	8-9	0	0
Mediterranean Scrub and Grassland; Temperate and Boreal Shrubland and Grassland	California Chaparral Cool Interior Chaparral	0	0	0	8	0	0	0	0
	California Annual and Perennial Grassland	0	0	0	<1	0	0	0	0
	California Ruderal Grassland and Meadow	0	0	0	10	0	0	0	0
Temperate Forest; Temperate & Boreal Shrubland & Grassland; Warm Semi-Desert Scrub & Grassland	Northern Rocky Mountain-Vancouverian Montane and Foothill Grassland and Shrubland Southern Rocky Mountain Montane Grassland and Shrubland	0	0	0	0	0	0	20-21	44
	Southern Vancouverian Lowland Grassland and Shrubland	0	0	21	0	0	0	0	0
	Northern Rocky Mountain-Vancouverian Montane and Foothill Grassland and Shrubland Southern Rocky Mountain Montane Grassland and Shrubland Great Plains Mixedgrass Prairie and Shrubland Great Plains Shortgrass Prairie and Shrubland	0	0	0	0	0	0	0	26

TABLE 4-9 (Cont.)
Projected Herbicide Treatments[1], as a Percent of Total Acres Treated, in Each Ecoregion for Each Vegetation Macrogroup Under All Alternatives

Vegetation Subclass(es)[1]	Vegetation Macrogroups[2]	Ecoregion: Tundra	Subarctic	Marine	Mediterranean	Subtropical Desert	Subtropical Steppe	Temperate Desert	Temperate Steppe
Temperate Forest; Temperate and Boreal Shrubland and Grassland; Warm Semi-Desert Scrub & Grassland (cont.)	Great Plains Shortgrass Prairie and Shrubland Apacherian-Chihuahuan Semi-Desert Grassland and Steppe	0	0	0	0	0	33	0	0
	Warm Interior Chaparral	0	0	0	0	26	43-44	0	0
	Chihuahuan Desert Scrub Southern Plains Scrub Woodland and Shrubland	0	0	0	0	32	4	0	0
Cool Semi-Desert Scrub and Grassland	Great Basin and Intermountain Dry Shrubland and Grassland Great Basin and Intermountain Tall Sagebrush Shrubland and Steppe	0	0	0	0	0	0	58-59	0
Annual graminoid or forb[3]		0	0	0	0	0	8	0	2
Perennial forb[3]		0	0	0	<1	<1	1	0	0
Riparian/wetland[3]		0	0	0	<1	36	4	1	0
More than one subclass		0	0	0	0	0	0	18-19	26
Total for all ecoregions		**0**	**0**	**<1**	**4**	**<1**	**9**	**71**	**16**

[1] Refers to treatments with all available herbicides.
[2] See Table 3-4, the Vegetation section in Chapter 3, and Appendix D for a description of vegetation subclasses and macrogroups.
[3] General vegetation types for which no macrogroups exist in these ecoregions.

All four of the alternatives analyzed in this PEIS involve the same geographic area as far as herbicide treatments, as well as the same assumed total acreage of herbicide treatments annually (932,000 acres). Under all alternatives, the breakdown in usage by ecoregion (Table 4-9) would also be the same. The primary differences among the alternatives are associated with the herbicides that would be available for use, and the relative proportion of their use (summarized in Table 2-4).

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under the No Action Alternative, the BLM would continue current vegetation management programs in 17 western states, and would treat an estimated 932,000 acres per year using both ground-based and aerial applications of the 18 previously approved herbicides. The impacts to vegetation under this alternative were included in the discussion for the Preferred Alternative of the 2007 PEIS (USDOI BLM 2007a:4-66 to 4-67).

Based on projected herbicide use under this alternative (Table 2-4), imazapic, triclopyr, tebuthiuron, clopyralid, and glyphosate would be used the most, together accounting for approximately 73 percent of the land area that would be treated. The risks and benefits of using these herbicides are discussed in the 2007 PEIS (USDOI BLM 2007a:4-48 to 4-66). Imazapic is used to manage species such as cheatgrass, hoary cress, and perennial pepperweed, and generally has a low to moderate risk to non-target vegetation. Triclopyr is an herbicide registered for aquatic use that is commonly used on woody riparian species, as well as wetland and aquatic invasives (e.g., Eurasian watermilfoil and purple loosestrife). It has a moderate to high risk to non-target plants. Tebuthiuron is used primarily to manage woody invasive plants in rangelands and ROWs. The BLM uses tebuthiuron to thin sagebrush and create more favorable habitat for sagebrush-dependent species such as sage-grouse. It has a moderate to high risk to non-target plants. Clopyralid is also used to control broadleaf weeds, and is used in forest and rangeland areas for the management of species such as diffuse and spotted knapweed, yellow starthistle, and bull, Canada, Scotch, and musk thistle. It generally has a low to moderate risk to non-target plants. Glyphosate is commonly used in areas where bare ground is desired, and in aquatic and riparian habitats to manage invasive plants such as purple loosestrife, giant reed, and water lilies. It generally has a low to moderate risk to non-target plants.

The goals, effectiveness, and extent of herbicide treatments would be much the same as at present. Herbicide treatments would be used in conjunction with other treatment methods to manage invasive plant species, with varying degrees of effectiveness at establishing and maintaining native and desirable plant communities. Additionally, repeated use of the same herbicides could allow target invasive plants to develop herbicide resistance over time. With multiple treatments over the long term, successful control of fire-adapted invasive species such as cheatgrass would help reduce fire risk, and maintenance and restoration of native plant communities would help maintain and restore historic fire regimes.

Monitoring of treatment sites would continue to be conducted to determine the effectiveness of treatments and the need for retreatment. Site revisits would be made to compare the targeted population size against pre-treatment data, to compare pre-treatment and post-treatment data, and to assess the establishment and recovery of desirable vegetation.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, herbicide treatment projects would be much the same as those under the No Action Alternative, except that aminopyralid, fluroxypyr, and rimsulfuron would be available for use in addition to all of the currently approved herbicides.

Based on projected herbicide use under this alternative (Table 2-4), rimsulfuron, triclopyr, tebuthiuron, clopyralid, aminopyralid, and imazapic would be used the most, together accounting for approximately 81 percent of the land area that would be treated. The new active ingredients would account for an estimated 27 percent of all acres treated, with rimsulfuron and aminopyralid accounting for approximately 26 percent of all acres treated. Compared to the No Action Alternative, use of imazapic, glyphosate, and picloram would decrease substantially with the introduction of these chemicals. Use of fluroxypyr would be minimal under this and the other action alternatives.

While the three new herbicides are generally low risk, they would still impact non-target plants under direct spray and spill scenarios, much like the herbicides that would be used most extensively under the No Action Alternative. Therefore, there would not be a substantial difference between the No Action Alternative and the

Preferred Alternative in terms of risk to non-target plants.

The introduction of the new active ingredients could increase the effectiveness of certain components of vegetation management by providing additional options for targeting invasive plants. Aminopyralid could be used to control of many of the species currently targeted by picloram (e.g., knapweeds, thistles, and yellow starthistle). This active ingredient is likely to receive an aquatic registration in the near future that would allow for incidental overspray of aquatic habitats during treatment of wetland and riparian vegetation. With such a registration, aminopyralid could be used in place of glyphosate for management of certain invasive plants in riparian areas. Because aminopyralid is more selective than glyphosate, it may be less likely to result in removal of non-target riparian vegetation.

Rimsulfuron would typically be used to manage cheatgrass and other annual grasses, and as such could be used instead of imazapic in some instances. Rimsulfuron has been observed to be more effective than imazapic in certain areas.

Fluroxypyr would be used minimally, but may increase the effectiveness of certain herbicide treatments relative to the No Action Alternative by controlling target species that are resistant to other herbicides, improving control of target species when mixed with other active ingredients, and reducing the amount of other herbicides products used in treatments.

Overall, there would be no change to the goals or extent of herbicide treatment programs, relative to the No Action Alternative, although it is possible that there could be an improvement in the effectiveness of certain treatments with the availability of the new herbicides. Improved effectiveness of treatments could allow the BLM to better meet its goals of managing undesirable vegetation, reducing fire risk, and restoring natural fire regimes.

Alternative C – No Aerial Application of New Herbicides

Under Alternative C, herbicide treatment projects would be much the same as those under the No Action and Preferred Alternatives, except that in addition to all the other currently approved herbicides, aminopyralid, fluroxypyr, and rimsulfuron would be available for use for ground treatments only.

Based on projected herbicide use under this alternative (Table 2-4), triclopyr, tebuthiuron, imazapic, clopyralid, and glyphosate would be used the most, together accounting for approximately 69 percent of the land area that would be treated, which is similar to the No Action Alternative. The new herbicides would account for approximately 10 percent of all acres treated, with rimsulfuron and aminopyralid accounting for 9 percent of all acres treated, or about one third of the amount under the Preferred Alternative.

Overall risks to non-target plants under this alternative would not be substantially different than under the other alternatives. The most commonly used herbicides would continue to pose a risk to non-target plants as a result of herbicide treatments, particularly under direct spray and spill scenarios.

Prohibiting aerial spraying of the three new herbicides would limit their usefulness. For example, given the abundance of cheatgrass and other invasive annual grasses and the extensiveness of planned treatments for these species, aerial spraying is one of the most cost-effective treatment methods. The BLM would not have the option to aerially spray rimsulfuron, and would instead continue to utilize imazapic for these applications. While the BLM would still have some options to utilize the three new active ingredients to increase the effectiveness of treatments, these options would be limited relative to the Preferred Alternative.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under this alternative, herbicide treatment projects would be much the same as under the other alternatives. Similar to the other action alternatives, new active ingredients would be available for use, but they would only include aminopyralid and fluroxypyr. Based on projected herbicide use under this alternative (Table 2-4), triclopyr, tebuthiuron, clopyralid, glyphosate, and aminopyralid would be used the most, together accounting for approximately 70 percent of the land area that would be treated. New herbicides would account for approximately 11 percent of all acres treated, with aminopyralid accounting for 10 percent.

In general, risks to non-target plants would be similar to those under the other alternatives. Herbicides would continue to pose a risk to non-target plants, particularly under direct spray and spill scenarios.

Prohibiting the use of rimsulfuron would give the BLM one fewer herbicide option for its herbicide treatments, relative to the Preferred Alternative and Alternative C. The BLM would continue to utilize imazapic for management of cheatgrass and other annual grasses. However, aminopyralid would be available as an option for management of undesirable broadleaf plants in upland and riparian habitats, and use of picloram would decrease by approximately the same amount as under the Preferred Alternative. The availability of aminopyralid and fluroxypyr could increase the effectiveness of certain treatments relative to the No Action Alternative, but this increase would be less than under the Preferred Alternative.

Mitigation for Herbicide Treatment Impacts

In addition to the SOPs identified earlier in this section and in the 2007 PEIS (USDOI BLM 2007a:Table 2-8), the following measures are recommended to reduce impacts to non-target vegetation from the use of herbicides:

- Use Table 4-8 to establish herbicide-specific buffer zones around downstream water bodies, and associated habitats and non-target plant species/populations of interest for aminopyralid, fluroxypyr, and rimsulfuron. Consult the ERAs for more specific information on appropriate buffer distances under different soil, moisture, vegetation, and application scenarios.

Special Status Plant Species

Introduction

As discussed in Chapter 3, public lands in the western U.S. support numerous plant species that have been given a special status based on their rarity or sensitivity. Special status plants include approximately 165 species that are federally listed as threatened or endangered, or are proposed for federal listing. The remaining special status species include candidates for federal listing, and other species that warrant special attention and could potentially require federal listing in the future. Many of these species are threatened by competition with non-native plants and other invasive species. The *Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States Biological Assessment* (USDOI BLM 2015) provides a description of the distribution, life history, and current threats of each federally-listed plant species, as well as species proposed for listing. The BA also discusses the risks to threatened and endangered species, and species proposed for listing, associated with the use of aminopyralid, fluroxypyr, and rimsulfuron by the BLM.

Impacts Assessment Methodology

The BLM reviewed the literature and findings from ERAs conducted by the BLM to assess the impacts to sensitive plant species from the use of herbicides (AECOM 2014a,b; AECOM 2015). The ERA methods are summarized in the Vegetation section of this chapter, and are presented in more detail in the *Vegetation Treatments Programmatic EIS Ecological Risk Assessment Protocol* (ENSR 2004) and in Appendix C of the 2007 PEIS.

The acute endangered species LOC for plants is 1, which is the same as that for typical plant species. However, separate plant toxicity endpoints were selected to provide extra protection to special status plant species. Thus, ERAs for some herbicides predicted higher risks for special status plant species than for "typical" plant species under certain exposure scenarios.

The potential risks to sensitive plant species from use of herbicides can be minimized by following certain SOPs. These SOPs were identified in the 2007 PEIS (USDOI BLM 2007a:Table 2-8, 4-71), and would continue to be implemented at the local level based on site conditions. These SOPs include:

- Survey for special status plant species, at a time they can be found and identified, before treating an area. Consider effects to special status species when designing herbicide treatment programs.
- Use drift reduction agents to reduce the risk of drift hazard.
- Use a selective herbicide and a wick or backpack sprayer to minimize risks to special plants.

Summary of Herbicide Impacts

The 2007 PEIS provides a general discussion of potential impacts (adverse and beneficial) to special status plant species from herbicide treatments (USDOI

2007a:4-71 to 4-73). This discussion considers the BLM's vegetation treatment program as a whole, and therefore would also be applicable to herbicide treatments that utilize the three new chemicals.

As many special status plant species are threatened by the spread of non-native plants, fuels reduction and control of competing vegetation are important components of management programs for special status plant species. Therefore, herbicide treatments conducted as part of these programs would be expected to benefit populations of special status plant species. Additionally, general program goals of restoring native communities and minimizing fire risk would also benefit these species by improving habitat conditions and in some cases reducing the risk of extirpation as a result of fire. The BA provides additional information on which listed and proposed plant species are most at risk from competition with non-native plants and for extirpation of populations from fire.

All herbicides would have the potential to harm populations and individuals of special status plant species. At the local level, locations and risks to sensitive plant populations would be considered when designing treatment projects, and the appropriate precautions would be taken to avoid impacts to these species. In some cases, manual spot treatments of herbicides would be the only feasible option for avoiding impacts to listed species. In other cases, some level of short-term mortality may be acceptable for long-term habitat improvement and increase in population size.

Impacts from Use of the Three New Herbicides

Based on information in the ERAs, all three herbicides would pose risks to terrestrial special status plant species under direct spray and off-site drift scenarios. The greatest risks to terrestrial special status plants from off-site drift would be associated with aerial applications, where buffer distances of 900 to 2,000 feet (depending on application rate and site conditions) would likely be required to protect populations of special status plant species (Table 4-8). For ground applications, smaller buffers of 25 to 700 feet would be required.

The vast majority of the BLM's special status plant species are terrestrial. However, there are also aquatic plant species (including species in wetland habitats) for which separate risk analyses were completed. Accidental direct spray or spill of fluroxypyr or rimsulfuron could result in harm to aquatic special status plant species. In the case of aminopyralid, however, ERAs did not predict risks to sensitive non-target aquatic plants under these exposure scenarios. Should aminopyralid receive an aquatic registration in the future that allows for incidental overspray into aquatic habitats, it is not expected that sensitive aquatic plants would be harmed by applications in adjacent upland or wetland areas. Off-site drift of fluroxypyr would not be expected to harm sensitive aquatic plants, assuming standard BLM buffers around aquatic habitats. However, special status aquatic plants would be at risk for harm from spray drift of rimsulfuron. Buffers of 100 to 300 feet would likely be required for ground applications, and buffers of 1,000 to 1,400 feet would likely be required for aerial applications of rimsulfuron.

Based on the predictions in the ERA, adverse effects to terrestrial special status plant species should not occur as a result of surface runoff of any of the three herbicides. Additionally, it is not expected that surface runoff of aminopyralid or fluroxypyr would harm sensitive aquatic plants in downslope habitats. However, surface runoff of rimsulfuron would have the potential to adversely affect special status aquatic plants, particularly in sandy soils and in areas with greater than 50 inches of rainfall per year.

Additional indirect effects to certain special status plant species could occur if populations of pollinators were harmed by herbicide spraying. However, according to risk assessments, risks to pollinators would be less than those associated with direct spray of the rare plants themselves. No adverse effects to pollinators were predicted for direct spray or dermal contact with vegetation sprayed by aminopyralid or rimsulfuron. Low risks to pollinators were predicted under scenarios involving direct spray by fluroxypyr. Management efforts to protect rare plants would also help prevent harm to insects in the vicinity. These management efforts include:

- Designating buffer zones around rare plants.
- Managing herbicide drift especially to nearby blooming plants.
- Using typical rather than maximum rates of herbicides in areas with rare plants.
- Choosing herbicide formulations that are not easily carried by social insects to hives, hills,

nests, and other ”homes” in areas with rare plants.

- Choosing herbicides that degrade quickly in the environment when herbicides must be used in rare plant habitat.
- Timing the herbicide applications when pollinators are least active, such as in the evenings or after blooming has occurred in rare plant habitat, and if necessary dividing the rare plant habitat into several treatments rather than one large treatment to keep from treating all blooming species at one time.

Effects to pollinators would be short-term, and population-level effects are not anticipated when these types of management practices are incorporated into project design when rare plants are present.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Impacts to special status plant species under this alternative were summarized in the 2007 PEIS under the discussion for the Preferred Alternative (USDOI BLM 2007a:4-74). Up to 932,000 acres of public lands would be treated with herbicides annually. Herbicide use would be associated with risks to special status plant species, although treatments would be designed at the local level to avoid or minimize risks to these species. Regardless of measures to avoid sensitive plant populations, there would be some risk of accidental exposure to herbicides. As identified in the 2007 PEIS, active ingredients with the greatest risks for adverse effects to special status plants would be 2,4-D, bromacil, diquat, diuron, hexazinone, and sulfometuron methyl.

Under this alternative, populations of special status plant species would benefit from herbicide treatments that reduce fuels (such as cheatgrass) and control non-native, invasive species that compete with native plants. Aminopyralid, fluroxypyr, and rimsulfuron would not be approved for use under this alternative, but the species that they target would continue to be managed using currently approved herbicides.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, the total acreage of public lands treated with herbicides annually would be the same as under the No Action Alternative and the other action alternatives. However, aminopyralid, fluroxypyr, and rimsulfuron could be used as part of vegetation management programs throughout the 17 western states. Special status plant species would continue to be at risk for harm from contact with herbicides, although treatments would continue to be designed to avoid or minimize impacts to special status plant species.

In considering the active ingredients with the greatest risk to non-target plants, discussed under Alternative A, there would be little change in the amount of these ingredients used under the Preferred Alternative, and all except 2,4-D would continue to make up a very small component of the total amount of herbicide used annually. Under the Preferred Alternative, 2,4-D use is estimated at 5 percent, versus 6 percent under the No Action Alternative.

While the three new active ingredients would not offer substantially different types of target species control, they may be able to increase the efficacy of individual treatments by addressing herbicide resistance issues, adding to the strength of other herbicides in tank mixes, and performing better than currently approved herbicides under certain site conditions.

Alternative C – No Aerial Application of New Herbicides

This alternative would be similar to the other alternatives as far as risks and benefits to special status plant species. Treatment acres would be the same as those under the other alternatives, and the suite of chemicals available would be the same as under the Preferred Alternative, except that aminopyralid, fluroxypyr, and rimsulfuron would only be available for application using ground methods; aerial spraying of these chemicals would not occur.

Since aerial spraying of herbicides would not occur in habitats that support listed species, and is unlikely to occur in many habitats that support populations of special status plant species, this alternative would not be substantially different than the Preferred Alternative as far as risks to sensitive plant species.

Herbicides with the greatest risk to non-target plants would continue to be used in small amounts, and at levels similar to those under the No Action Alternative.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

This alternative would be similar to the other alternatives as far as total acres treated and herbicides available for use, except that rimsulfuron would not be added to the list of approved active ingredients. Aminopyralid and fluroxypyr would be integrated into herbicide treatment programs, including those designed to improve habitats occupied by, or that could be occupied by, special status plant species.

Because rimsulfuron would not be available for use, the relative amount of each herbicide used under this alternative would be very similar to the breakdown under the No Action Alternative. Most importantly, the relative use of herbicides with the greatest risks to non-target plants also would be very similar to the use of these chemicals under the No Action Alternative. These chemicals would continue to be used in small quantities, and risks to non-target sensitive plant species would be similar to those under the other alternatives.

Mitigation for Herbicide Treatment Impacts

When using the previously approved herbicides, the BLM would continue to follow mitigation for vegetation and special status plants identified in the 2007 PEIS. The following mitigation is recommended to reduce the likelihood of impacts to special status plant species from applications of aminopyralid, fluroxypyr, and rimsulfuron. This mitigation should be implemented in addition to the SOPs designed to protect plants presented in Chapter 2 and the general mitigation recommended in the Vegetation section.

- To protect special status plant species, implement all conservation measures for plants presented in the *Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States Biological Assessment* (USDOI BLM 2015). Apply these measures to sensitive plant species, as well as listed species.

Fish and Other Aquatic Organisms

Introduction

The proposed herbicide treatments have the potential to affect fish and other aquatic organisms, predominantly through indirect effects to aquatic habitats and adjacent riparian and upland areas. Noxious weeds and other non-native invasive species can be detrimental to aquatic habitats. Infestations of riparian systems and other habitats by non-native plants can reduce the ability of these systems to support fish and other aquatic organisms. Non-native plants can affect stream morphology and habitat characteristics, bank erosion, flow levels, and populations of native insects that provide a food source for fish. Removal of invasive species can help to restore a more complex vegetative and physical structure and natural levels of processes such as sedimentation and erosion.

Scoping Comments and Other Issues Evaluated in the Assessment

None of the scoping comments received were specific to fish or other aquatic organisms. However, comments concerned with the potential for the new herbicides to impact water resources would also apply to aquatic organisms and their habitats. Additionally, comments that support the new herbicides for their limited environmental risk are applicable.

Standard Operating Procedures

The SOPs listed in the 2007 PEIS would be followed for treatments with aminopyralid, fluroxypyr, and rimsulfuron, as applicable:

- Develop and update an operational plan for each herbicide project that includes information on project specifications; key personnel responsibilities; communication procedures; safety, spill response, and emergency procedures; and minimum buffer widths for herbicides not approved for aquatic use.

- Use appropriate buffer zones based on label and risk assessment guidance.

- Minimize treatments near fish-bearing water bodies during periods when fish are in life stages most sensitive to the herbicide(s) used, and use spot rather than aerial treatments.

- Use appropriate application equipment and methods near water bodies if the potential for off-site drift exists.

- Where feasible, use spot hand applications within 20 feet of perennial streams and non-perennial streams with flowing water at the time of application.

- Use herbicides that are least toxic to fish, yet still effective.

- For treatment of aquatic vegetation, 1) treat only that portion of the aquatic system necessary to achieve acceptable vegetation management, 2) use the appropriate application method to minimize the potential for injury to desirable vegetation and aquatic organisms, and 3) follow use restrictions on the herbicide label.

Additional mitigation for fish and aquatic organisms is presented in the ROD for the 2007 PEIS (USDOI BLM 2007b:Table 2). Many of these mitigation measures would apply to treatments involving the three new herbicides, or tank mixes with these active ingredients.

- Limit the use of terrestrial herbicides (especially diuron) in watersheds with characteristics suitable for potential surface runoff that have fish-bearing streams during periods when fish are in life stages most sensitive to the herbicide(s) used.

- To protect special status fish and other aquatic organisms, implement all conservation measures for aquatic animals presented in the *Biological Assessment for Vegetation Treatments on Bureau of Land Management Lands in 17 Western States* (USDOI BLM 2007f).

- Establish appropriate herbicide-specific buffer zones for water bodies, habitats, or fish or other aquatic species of interest (see the 2007 PEIS [USDOI BLM 2007a:Appendix C, Table C-16], as well as recommendations in individual ERAs [AECOM 2014a,b; AECOM 2015]).

- Consider the proximity of application areas to salmonid habitat and the possible effects of herbicides on riparian and aquatic vegetation. Maintain appropriate buffer zones around salmonid-bearing streams (see the 2007 PEIS [USDOI BLM 2007a:Appendix C, Table C-16], as well as recommendations in individual ERAs [AECOM 2014a,b; AECOM 2015]).

- At the local level, consider effects to special status fish and other aquatic organisms when designing treatment programs.

Impacts Assessment Methodology

The methods used to assess impacts to fish and aquatic organisms from the three new herbicides were the same as the methods described in the 2007 PEIS (USDOI BLM 2007a:4-77 to 4-79). A brief overview of the risk assessment process is provided here.

Risk Assessment Methodology

Aquatic receptors (fish and aquatic invertebrates) were evaluated to determine the effects of herbicide exposure in terms of certain assessment endpoints and associated measures of effect. The assessment endpoint is an expression of the value that is to be protected. In the case of aquatic organisms, assessment endpoints include survival, growth, and reproduction. These assessment endpoints generally reflect direct effects on organisms, but indirect effects were also considered.

Measures of effect are measurable changes in an attribute of an assessment endpoint (or its surrogate, as discussed below) in response to a stressor to which it is exposed (USEPA 1998b). For ERAs, they generally consisted of acute and chronic toxicity data (from pesticide registration documents and from the available scientific literature) for the most appropriate surrogate species.

Because the BLM uses herbicides in a variety of programs with several different application methods, the following exposure scenarios were considered to assess the potential ecological impacts of herbicides to fish and other aquatic organisms under a variety of uses and conditions:

- Direct spray of the receptor or water body.

- Off-site drift of spray to terrestrial areas and water bodies.

- Surface runoff from the application area to off-site soils or water bodies.

- Wind erosion resulting in deposition of contaminated dust into water bodies.

- Accidental spills to water bodies.

Direct spray scenarios considered both a pond (1/4 acre, 1 meter [3.3 feet] deep) and a stream (representative of Pacific Northwest low-order streams that provide habitat for critical life stages of anadromous salmonids). Accidental spill scenarios were limited to a pond, which represents a worst-case scenario for a spill into an aquatic habitat.

The AgDRIFT computer model was used to estimate off-site herbicide transport due to spray drift. The GLEAMS computer model was used to estimate off-site transport of herbicides in surface runoff and root zone groundwater transport. The CALPUFF computer model was used to predict the transport and deposition of herbicides sorbed (i.e., reversibly or temporarily attached) to wind-blown dust. Each model simulation was approached with the intent of predicting the maximum potential herbicide concentration that could result from the given exposure scenario.

Toxicological data for aquatic organisms were extrapolated from data for representative or surrogate species. Data describing both acute and chronic effects were used to generate RQs for addressing potential risks to aquatic receptors (see the ERAs [AECOM 2014a,b; AECOM 2015] or the 2007 PEIS [USDOI BLM 2007a:4-100] for additional discussion of these calculations). In order to address potential risks to these receptors from exposure to the herbicides, RQs were compared to LOCs defined by the USEPA for screening the potential risk of pesticides. Distinct USEPA LOCs were used for acute and chronic risks, and for potential increased risks to special status species. For non special status fish and aquatic invertebrates, LOCs were 0.5 for acute high risk, and 1 for chronic risk. Wherever the RQ exceeded the applicable LOCs, it was assumed that adverse toxicological effects to the group in question (fish or invertebrates) could occur. Corresponding levels of risk (none, low, medium, or high) were obtained by determining the factor by which the RQ exceeded the LOC, and the number of modeled scenarios in which an exceedance occurred.

Adjuvants, Degradates, Inert Ingredients, and Tank Mixes

Adjuvants

The potential risks to aquatic organisms from adjuvants were raised as a concern during the 2007 PEIS process. Adjuvants generally function to enhance or prolong the activity of an active ingredient, and are not under the same registration guidelines as pesticides. In general, adjuvants comprise a relatively small portion of the volume of herbicide applied. Adjuvants listed for use with the three new herbicides include the following:

- Aminopyralid – a nonionic surfactant.

- Fluroxypyr – a methylated seed oil surfactant.

- Rimsulfuron – several types of spray adjuvants (e.g., nonionic surfactant, petroleum crop oil concentrate, modified seed oil, ammonium nitrogen fertilizer, and combination adjuvant products).

The BLM reviewed toxicity data for these adjuvants to assess risks to aquatic life. In addition, the GLEAMS model was used in the ERAs to estimate the potential portion of an adjuvant that might reach an adjacent water body via surface runoff.

Degradates

It was beyond the scope of the ERAs to evaluate all of the possible degradates of the herbicide formulations being considered in this PEIS. Degradates may be more or less mobile and more or less toxic in the environment than their source herbicides (Battaglin et al. 2003). Differences in environmental behavior (e.g., mobility) and toxicity between parent herbicides and degradates makes prediction of potential impacts challenging. For example, a less toxic, but more mobile bioaccumulative, or persistent degradate may have a greater adverse impact due to residual concentrations in the environment. The lack of data on the toxicity of degradates of the specific herbicides represents a source of uncertainty in the risk assessment.

This PEIS relies on information obtained during preparation of the 2007 PEIS to determine the likely effects of degradates on aquatic organisms. The BLM conducted studies to evaluate information on degradates and try to determine if it is likely for degradates to be more toxic than the parent compounds (active ingredients; see Appendix D of the 2007 PEIS).

Inert Ingredients

The BLM reviewed confidential information on inert compounds used in herbicide formulations with aminopyralid, fluroxypyr, and rimsulfuron. Additionally, the ERAs used the GLEAMS model to simulate the effects of a generalized inert compound in a base-case watershed (annual precipitation rate of 50 inches per year, application area of 10 acres, slope of 0.05, surface roughness of 0.015, erodibility of 0.401 tons per acre, vegetation type of “weeds”) with a sand soil type (see Appendix D of the ERAs; AECOM 2014a,b; AECOM 2015).

Tank Mixes

The ERAs for aminopyralid, fluroxypyr, and rimsulfuron did not include a quantitative evaluation of potential tank mixes for these active ingredients. Therefore, information on simulations of tank mixes in risk assessments completed for the 2007 PEIS were used as guidance for determining how risks to aquatic organisms may change when a tank mix is used, as compared to the active ingredient alone. Aquatic organisms may be at greater risk from the mixed application than from the active ingredient alone. Typical tank mixes of the three herbicides are discussed in Chapter 2 of this PEIS.

Summary of Herbicide Impacts

The general impacts to fish and other aquatic organisms as a result of herbicide treatments are discussed in the 2007 PEIS (USDOI BLM 2007a:4-80). Herbicides may come into contact with fish and aquatic invertebrates by entering a water body, with potential impacts that include mortality, reduced productivity, abnormal growth, and alteration of critical habitat. Factors that influence an herbicide’s risk to aquatic organisms include size of aquatic buffers, application rate, application method, precipitation rate, soil type, and herbicide mobility and persistence.

All herbicides pose some risk to non-target terrestrial and aquatic plants. These risks should be considered, as damage to riparian and aquatic plants may affect fish and aquatic invertebrates. Potential effects from vegetation removal in riparian areas include loss of necessary habitat components (i.e., cover and food), increased sedimentation into aquatic habitats, altered nutrient dynamics, and increased water temperature due to a reduction in shade. The sections on Vegetation and Wetlands and Riparian Areas in this chapter discuss these risks, as well as herbicide application practices that can be used to reduce risk.

Based on the likely use of the three new active ingredients, wide-scale removal of riparian vegetation is unlikely to occur. Out of the three, fluroxypyr and rimsulfuron would typically not be used near water, except possibly for spot treatments of certain target species. Aminopyralid would be used in riparian treatments for selective removal of certain species (e.g., knapweeds), but extensive removal of riparian vegetation would be unlikely. Additionally, aminopyralid would provide an alternative to glyphosate, which is less selective and more likely to result in removal of non-target vegetation.

The BLM’s land management goals include restoring and enhancing fish habitat, and restoring and maintaining proper functioning condition of riparian and wetland areas. Vegetation treatment programs in these areas include herbicide treatments to remove noxious weeds and other invasive species from these areas. Such treatments, as part of an overall habitat improvement program, would be expected to have a beneficial effect on fish and other aquatic organisms by improving stream/aquatic habitat conditions and restoring important riparian habitat components for juvenile fish growth, development, and survival, such as streambank structure and complexity, habitat complexity, and water quality (Groot and Margolis 1991).

Impacts of Aminopyralid

Aminopyralid is not currently registered for aquatic uses, although it may receive an aquatic registration in the near future that would address incidental overspray of aquatic areas during treatment of adjacent upland areas. Even with this registration, aminopyralid would not be used to manage aquatic vegetation, and would not be applied directly to the water column like other aquatic herbicides.

The ERA for aminopyralid indicates that this herbicide would not pose a risk to fish or aquatic invertebrates in ponds or streams as a result of any of the modeled exposure scenarios (Table 4-10). The ERA included a direct spray scenario and a worst-case scenario involving a spill of the active ingredient into the aquatic habitat, as well as off-site drift and surface runoff scenarios.

TABLE 4-10
Risk Categories Used to Describe Herbicide Effects on Non Special Status Fish and Aquatic Invertebrates According to Exposure Scenario

Application Scenario	Aminopyralid		Fluroxypyr		Rimsulfuron	
	Typ[1]	Max[1]	Typ	Max	Typ	Max
Direct Spray/Spill						
Fish pond	0[2] [2:2]	0 [4:4]	0 [2:2]	0 [4:4]	0 [2:2]	0 [4:4]
Fish stream	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]
Aquatic invertebrates pond	0 [2:2]	0 [4:4]	0 [2:2]	0 [4:4]	0 [2:2]	0 [4:4]
Aquatic invertebrates stream	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]
Off-Site Drift						
Fish pond	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]
Fish stream	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]
Aquatic invertebrates pond	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]
Aquatic invertebrates stream	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]
Surface Runoff						
Fish pond	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]
Fish stream	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]
Aquatic invertebrates pond	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]
Aquatic invertebrates stream	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]

[1] Typ = Typical application rate; and Max = Maximum application rate.
[2] Risk categories: 0 = No risk (majority of RQs < applicable LOC for non special status species). The Risk Category is based on the risk level of the majority of risk quotients observed in any of the scenarios for a given exposure group and receptor type. The reader should consult the risk tables in Chapter 4 of the ERAs (AECOM 2014a,b; AECOM 2015) to determine the specific scenarios that result in the displayed level of risk for a given receptor group.

Based on toxicity data reviewed for the ERA, aminopyralid exposures to fish of as high as 100 ppm did not result in any observable mortality or sub-lethal effects. Additionally, the ERA indicates that aminopyralid is not likely to accumulate in fish tissue. Toxicity data for aquatic invertebrates was similar, with no adverse effects observed at concentrations of nearly 100 ppm.

Impacts of Fluroxypyr

Fluroxypyr is not registered for use in aquatic systems. Therefore, routes for exposure to aquatic organisms would be limited to accidental direct spray through a misapplication or an accidental spill, or through off-site drift or surface runoff. The SOPs and guidelines listed in the 2007 PEIS and discussed in Chapter 2 of this document would minimize the risks for misapplications or accidental spills into aquatic habitats. Relevant SOPs include preparing a spill contingency plan in advance of treatments, mixing and loading herbicide products in an area where an accidental spill would not reach a water body, not rinsing spray tanks in or near water bodies, following product labels for use and storage, and having licensed applicators apply the herbicides.

The ERA for fluroxypyr indicates that this herbicide would not pose a risk to non special status fish or aquatic invertebrates in ponds or streams under any of the modeled exposure scenarios (Table 4-10). The ERA included a direct spray scenario and a worst-case scenario involving a spill of the active ingredient into the aquatic habitat, as well as off-site drift and surface runoff scenarios.

Based on toxicity data presented in the ERA, no effects to fish were observed after exposure to fluroxypyr at concentrations of approximately 7 milligrams per liter (mg/L). The ERA also indicated that based on the literature, fluroxypyr may accumulate in fish tissue. Toxicity data for aquatic invertebrates indicated that no adverse effects were observed at concentrations of 56 mg/L. While the ERA considered freshwater species as surrogates, information from the USEPA (1998a) indicates that the acid form of fluroxypyr is highly toxic to certain marine invertebrates.

Impacts of Rimsulfuron

Rimsulfuron is not registered for use in aquatic systems. Therefore, possible routes for exposure to aquatic organisms would be the same as those for fluroxypyr: accidental direct spray or spill, off-site drift, or surface runoff. The SOPs and guidelines discussed in the previous section for fluroxypyr would help prevent and control spills and other releases into aquatic habitats.

Based on the results of the ERA, none of the modeled exposure scenarios were associated with risks to fish or aquatic invertebrates in streams or ponds, even under the worst case accidental spill scenarios (Table 4-10). Based on toxicity data reviewed for the ERA, exposures to concentrations of rimsulfuron as high as 390 mg/L does not result in adverse effects to fish, although the potential for chronic effects is not known. Additionally, the ERA indicates that rimsulfuron is not likely to accumulate in fish tissue. Lower concentrations of the herbicide were noted to cause adverse effects to aquatic invertebrates, with test organisms affected at 50 mg/L of rimsulfuron.

Impacts of Adjuvants, Degradates, Inert Ingredients, and Tank Mixes

Adjuvants

The findings of analysis of adjuvants in the ERA indicate that there is no risk to aquatic organisms associated with the adjuvant identified for aminopyralid, and very low risks associated with adjuvants identified for fluroxypyr and rimsulfuron. The methylated seed oil identified for fluroxypyr may be a concern under spill and long-term exposure scenarios, neither of which are likely under the proposed treatment programs. An inert/adjuvant compound identified for rimsulfuron could potentially cause behavioral and physiological effects at very high exposure scenarios, which are also unlikely.

When selecting adjuvants, BLM land managers must follow all label instructions and abide by any warnings. In general, adjuvants compose a relatively small portion of the volume of herbicide applied. Nonetheless, selection of adjuvants with limited toxicity and low volumes is recommended for applications near aquatic habitats to reduce the potential for the adjuvant to influence the toxicity of the herbicide.

Degradates

Based on the analysis of degradates in the 2007 PEIS, previous studies have determined that degradates are often not identified or named in registration documents and their physical and chemical attributes are often poorly understood. The ERAs completed for aminopyralid, fluroxypyr, and rimsulfuron factored in the lack of data on the toxicity of degradates as a source of uncertainty in the risk assessment process. Numerous degradates of other herbicides have a similar or reduced toxicity to the parent herbicide, but some may be more toxic than the parent herbicide (Sinclair and Boxall 2003).

Inert Ingredients

As a result of the BLM's review of confidential information on inert compounds, it was found that all of the inert ingredients identified in the formulations were classified as approved for "food and nonfood use," which means that they are approved for use in pesticide products applied to food.

The ERAs determined that inert ingredients associated with aminopyralid, fluroxypyr, and rimsulfuron are not predicted to occur at levels that would cause acute toxicity to aquatic life. It is assumed that toxic inert ingredients would not represent a substantial percentage of the herbicide, and that minimal impacts to aquatic habitats would result from these ingredients.

Tank Mixes

Use of tank mixes can result in changes to the toxic effects of herbicides in the mixture. Herbicide interactions can be additive, synergistic, or antagonistic, and the mixture may have more or less toxicity than any of the individual products. Based on simulations of tank mixes in risk assessments completed for the 2007 PEIS, aquatic organisms may be at greater risk from applications of a mix of active ingredients than from use of a single active ingredient alone. There is some uncertainty in this evaluation because herbicides in tank mixes may not interact in an additive manner. Thus, the evaluation may overestimate risk if the interaction is antagonistic, or it may underestimate risk if the interaction is synergistic. In addition, other products may also be included in tank mixes that may contribute to the potential risk.

To reduce the potential for adverse impacts to aquatic organisms, BLM land managers must follow all label instructions and abide by any warnings. Labels for both tank mixed products should be thoroughly reviewed, and mixtures with the least potential for negative effects should be selected, particularly when a mixture is applied in a manner that increases the potential for risk to nearby aquatic organisms.

Impacts by Alternative

The BLM proposes to treat riparian vegetation with the three new herbicides to improve habitat for fish and aquatic organisms on public lands. However, herbicide treatments can also lead to the harm or even death of fish and aquatic organisms. The following discusses the habitat benefits and health risks to fish and aquatic organisms under each alternative.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under the No Action Alternative, the BLM would continue its ongoing vegetation treatments programs in the 17 western states with the 18 currently approved active ingredients. Approximately 932,000 acres would be treated annually, with approximately 10,000 acres of aquatic and riparian habitat treated.

The potential impacts to fish and other aquatic species under this alternative are discussed in the 2007 PEIS (USDOI BLM 2007a:4-90 to 4-91). Use of herbicides would result in some toxicological impacts to fish, with long-term beneficial effects to fish through improvements to aquatic and riparian areas through removal of invasive species from these habitats.

The greatest risks to fish and other aquatic organisms would be associated with the use of diquat, triclopyr, and certain (non-aquatic) formulations of 2,4-D and glyphosate. However, many of the currently approved herbicides would have some level of risk to aquatic organisms under spill and accidental direct spray exposure scenarios. Buffer distances specified in the 2007 PEIS would continue to be applied to herbicide treatments to protect aquatic species, and SOPs for mixing, handling, transporting, and applying herbicides would continue to be implemented to minimize the likelihood of accidental spills and direct spray into aquatic habitats.

The currently approved herbicides include active ingredients that would continue to be used to manage invasive aquatic plant species such as Eurasian watermilfoil and water-thyme, species that alter riparian habitats such as common reed, saltcedar, and Japanese knotweed, and rangeland species that increase the risk of fire and associated sedimentation into aquatic habitats, such as cheatgrass. Treatment programs to improve riparian and aquatic habitats would continue under the No Action Alternative, which would be expected to benefit fish and other aquatic species.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under the Preferred Alternative, the amount of herbicide treatment on BLM-administered lands would be the same as under the No Action Alternative, but treatments could include use of aminopyralid, fluroxypyr, and rimsulfuron. The projected acreage of aquatic and riparian habitat treated annually with herbicides would also be the same as under the No Action Alternative, estimated at 10,000 acres.

As discussed previously, of the three new active ingredients none would be applied directly to the water column, although aminopyralid is likely to receive a registration that would allow for incidental overspray into aquatic habitats. None of the herbicides would be used to treat invasive aquatic plant species, but aminopyralid would be used in riparian treatments for selective removal of invasive riparian and wetland species. Fluroxypyr and rimsulfuron would most likely be used for spot treatments of certain target species.

Given that the three new herbicides have no risk to aquatic species (Table 4-10), their use in the BLM's vegetation management programs would be unlikely to have an adverse effect on aquatic species, and could result in a benefit to these species if they were used instead of active ingredients with more toxicological risk. As shown in Table 2-4, use of glyphosate, imazapic, and picloram would decrease by the greatest amount under this alternative. Of these, picloram and glyphosate both have a substantially greater toxicological risk to aquatic organisms than the three new active ingredients. Therefore, it is possible that aquatic organisms would be exposed to lower quantities of more harmful chemicals under this alternative.

As far as benefits to aquatic species through habitat improvements, effects under this alternative would be much the same as under the No Action Alternative. Invasive aquatic species would continue to be treated with the same chemicals as at present. The three new herbicides would be used in riparian and upland areas to target largely the same species as under the No Action Alternative.

Alternative C – No Aerial Application of New Herbicides

Nearly all (98 percent) of the targeted aquatic and riparian habitats are treated using ground-based methods. Therefore, prohibiting aerial applications of the three new herbicides under this alternative would have a minimal effect on the BLM's use of chemicals in and around these habitats, relative to the Preferred Alternative. Additionally, benefits to aquatic species from removal of invasive species in aquatic and riparian habitats would be similar to those under the other alternatives.

The projected breakdown of herbicides used would be slightly different than under the No Action and Preferred Alternatives. Use of glyphosate would decrease relative to the No Action Alternative, but not as much as under the Preferred Alternative. Use of picloram would be only slightly lower than under the No Action Alternative. Therefore, there could be a minor benefit to aquatic organisms through a reduction in toxicological risks associated with the use of glyphosate.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under Alternative D, aminopyralid and fluroxypyr would be added to the list of approved active ingredients, but rimsulfuron would not. As rimsulfuron's use near aquatic habitats would be minimal under the other action alternatives, banning its use would have very little effect on treatment programs that affect habitats used by fish and other aquatic species. Similar to the other action alternatives, aminopyralid would be used near aquatic habitats for treatment of undesirable wetland and riparian plants that can impact fish and other aquatic organisms.

Rimsulfuron would not be used as an option for treating cheatgrass under this alternative, but imazapic would continue to be used to manage this species to reduce fire risk and prevent fire-related sedimentation into aquatic habitats. As both imazapic and rimsulfuron pose a very low risk to aquatic species, there would be little difference between Alternative D and the other action alternatives as far as toxicological risks. The breakdown of herbicide use under this alternative would be similar to the No Action Alternative, with only a slight decrease in the use of most active ingredients resulting from the addition of aminopyralid and fluroxypyr. The greatest decrease relative to the No Action Alternative would be in the use of metsulfuron methyl (3 percent), which has a low risk to aquatic species.

Mitigation for Herbicide Treatment Impacts

In order to protect non special status fish and aquatic invertebrates from potential toxicological effects associated with herbicide treatments, the BLM would continue to follow all applicable minimum buffer distances for aquatic habitats, as well as all SOPs for transport, handling, and application of herbicides. The mitigation measures specified in the 2007 PEIS (USDOI BLM 2007a:4-92) would also apply to treatments involving the new herbicides, including applications of tank mixes that include the currently approved herbicides.

Based on the results of ERAs, no additional buffers or other mitigation measures specific to aminopyralid, fluroxypyr, or rimsulfuron are warranted.

Special Status Fish and Other Aquatic Organisms

Introduction

As discussed in Chapter 3, BLM lands in the western U.S. support numerous aquatic animals that have been given a special status based on their rarity or sensitivity. Included are fish, mollusks, and aquatic arthropods that are federally-listed as threatened or endangered, or are proposed for federal listing. The *Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States Programmatic Biological Assessment* (USDOI BLM 2015) provides a description of the distribution, life history, and current threats of each federally listed aquatic species that could potentially be affected by the BLM's herbicide treatment programs, as well as species proposed for listing.

Impacts Assessment Methodology

Assessment of impacts to sensitive aquatic animal species followed the same general methodology that was developed for the 2007 PEIS (USDOI BLM 2007a:4-92 to 4-94). This methodology entailed following the protocol for completing ERAs that was developed with input from the USFWS, NMFS, and USEPA (ENSR 2004). The ERA methods for assessing impacts to aquatic organisms in general are summarized earlier in this section. To complete the ERA, a more conservative LOC of 0.05 (compared to an LOC of 0.5 for non special status species) was used to determine acute risks to special status fish and aquatic invertebrates. A more conservative LOC of 0.5 (compared to 1 for non special status species) was used to determine chronic risks.

Corresponding levels of risk (none, low, medium, or high) were obtained by determining the factor by which the RQ exceeded the LOC, and the number of modeled scenarios in which an exceedance occurred.

The results of the ERA analysis for two groups of aquatic organisms—special status fish and aquatic invertebrates—were used to determine the potential impacts to sensitive aquatic species, which are presented in the BA (USDOI BLM 2015). The analysis presented here incorporates the findings of the BA, and presents a comparison of the alternatives.

Summary of Herbicide Effects to Special Status Fish and Aquatic Invertebrates

A summary of the general effects of herbicide treatments on sensitive fish species and populations is presented in the 2007 PEIS (USDOI BLM 2007a:4-93 to 4-94). While the general toxicological risks to individual organisms of sensitive species would be the same as those predicted for non special status fish species, which were described earlier in this chapter, the associated population- and species-level effects could be much greater for many sensitive species because of their limited/fragmented distribution and limited population size.

In general, risks to special status fish and aquatic invertebrates from herbicide treatments would be minimized by following applicable SOPs, which include the following:

- Survey for special status fish and aquatic invertebrate species before treating an area. Consider effects to special status species when designing herbicide treatment programs.

- Use drift reduction agents to reduce the risk of drift hazard.

- Select herbicide products carefully to minimize additional impacts from degradates, adjuvants, inert ingredients, and tank mixtures.

- Maintain appropriate buffer zones between treatment areas and water bodies with special status fish and aquatic invertebrates.

- Minimize treatments near water bodies during periods when fish and aquatic invertebrates are in the life stage most sensitive to the herbicide used.

Because the invasion and spread of non-native plant species in aquatic and riparian habitats affects certain populations of special status fish and aquatic invertebrates, herbicide treatments to control these species would benefit sensitive aquatic organisms by improving water quality and flow, and increasing dissolved oxygen. However, for most of the sensitive fish and other aquatic species analyzed in the BA, the primary threats to the species are changes in water levels and quality associated with development, upslope land use practices, groundwater pumping, and the expansion of non-native fish populations. For these species, the potential for water quality impacts associated with herbicide use may outweigh habitat improvements resulting from minimized invasive plant infestations.

The typical risk levels for special status aquatic animals associated with applications of the three new herbicides are presented in Table 4-11. As shown in the table, the risk level for all of the active ingredients are shown as 0, or “no risk,” which means that the majority of risk quotients are less than the LOC used for special status species. In the case of aminopyralid and rimsulfuron, no risks to sensitive fish and aquatic invertebrates were predicted under any of the modeled scenarios. In the case of fluroxypyr, there would be no risks associated with accidental direct spray of the active ingredient, but there would be a low risk to special status fish associated with a truck or helicopter spill of the active ingredient. Special status aquatic invertebrates could be at risk from a helicopter spill of fluroxypyr.

TABLE 4-11
Risk Categories Used to Describe Herbicide Effects on Special Status Fish and Aquatic Invertebrates According to Exposure Scenario

Application Scenario	Aminopyralid		Fluroxypyr		Rimsulfuron	
	Typ[1]	Max[1]	Typ	Max	Typ	Max
Direct Spray/Spill						
Fish pond	0[2] [2:2]	0 [4:4]	0 [2:2]	0 [2:4]	0 [2:2]	0 [4:4]
Fish stream	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]
Aquatic invertebrates pond	0 [2:2]	0 [4:4]	0 [2:2]	0 [3:4]	0 [2:2]	0 [4:4]
Aquatic invertebrates stream	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]
Off-Site Drift						
Fish pond	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]
Fish stream	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]
Aquatic invertebrates pond	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]
Aquatic invertebrates stream	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]
Surface Runoff						
Fish pond	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]
Fish stream	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]
Aquatic invertebrates pond	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]
Aquatic invertebrates stream	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]

[1] Typ = Typical application rate; and Max = Maximum application rate.
[2] Risk categories: 0 = No risk (majority of RQs < most conservative LOC for special status species). The Risk Category is based on the risk level of the majority of risk quotients observed in any of the scenarios for a given exposure group and receptor type. For some "no risk" exposure groups, RQs for one or more scenarios exceeded the applicable LOC. The reader should consult the risk tables in Chapter 4 of the ERAs (AECOM 2014a,b; AECOM 2015) to determine the specific scenarios that result in the displayed level of risk for a given receptor group.

The BLM's SOPs would minimize the risks of spills into aquatic habitats. Relevant SOPs include preparing a spill contingency plan in advance of treatments, mixing and loading herbicide products in an area where an accidental spill would not reach a water body, not rinsing spray tanks in or near water bodies, following product labels for use and storage, and requiring licensed applicators to apply the herbicides. Project design criteria also require the BLM to consider sensitive species that occur near potential treatment areas when developing site-specific vegetation treatment programs.

Impacts by Alternative

For the most part, the comparison of alternatives for special status fish and aquatic invertebrates is similar to that for all aquatic animals, which was presented earlier in this section. While risk levels associated with fluroxypyr are slightly higher for special status species than for non special status species, fluroxypyr treatments would make up only 1 percent or less of total herbicide use (across all habitat types; see Table 2-4) under all alternatives.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under this alternative, the BLM would continue its vegetation treatment programs at current levels and with currently approved herbicides, with approximately 10,000 acres of aquatic and riparian habitats targeted for herbicide treatments annually. Programs would likely continue to include habitat restoration components that are specifically designed to improve habitat for sensitive species. Use of herbicides may be included in these programs.

Under this alternative, there would be some risk to sensitive aquatic species from use of herbicides, particularly the more toxic formulations, such as glyphosate.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, the goals of vegetation treatment programs would be the same as under the No Action Alternative, including treatments that target restoration and improvement of special status aquatic species habitats. The total acreage of aquatic and riparian habitat treated annually would also be the same as under the No Action Alternative.

The 2007 PEIS indicates that the currently approved active ingredients with the greatest likelihood of impacting special status aquatic animals are diuron, picloram, and the more toxic formulation of glyphosate. With the addition of aminopyralid, fluroxypyr, and rimsulfuron under this alternative, use of glyphosate and picloram would decrease. Use of diuron would also decrease, but to a lesser degree (Table 2-4). Together, use of these three active ingredients would decrease by 12 to 13 percent. Therefore, overall risks to aquatic special status species would potentially be lower than under the No Action Alternative.

Alternative C – No Aerial Application of New Herbicides

Since few aerial applications target aquatic and riparian areas, this alternative is likely to be similar to Alternative B as far as benefits to aquatic habitats and risks to sensitive aquatic species. The three herbicides of concern (glyphosate, picloram, and diuron) would decrease by 5 to 6 percent. Therefore, there could be some reduced toxicological risk to special status aquatic species relative to the No Action Alternative, but potentially less than under the Preferred Alternative.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Since rimsulfuron is not used extensively near aquatic habitats, prohibition of its use under this alternative would have little effect as far as impacts to special status aquatic species. Decrease in the use of glyphosate, picloram, and diuron would be 5 to 6 percent under this alternative. Therefore the potential for reduced risk to special status aquatic species would be similar to that under Alternative C, and potentially less than under the Preferred Alternative.

Mitigation for Herbicide Treatment Impacts

Mitigation to reduce the likelihood of impacts to special status fish and other aquatic species, as included in the ROD for the 2007 PEIS, would continue to be implemented, as would all SOPs and mitigation presented earlier in this section. These measures would be applied to the three new herbicides, as relevant. The *Biological Assessment for Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States* determined that given the low toxicity of the three new herbicides to aquatic special status species, likely uses of the herbicides, and SOPs for minimizing the risks for spills into aquatic habitats, no new conservation measures were necessary for herbicide treatments using aminopyralid, fluroxypyr, or rimsulfuron (USDOI BLM 2015). However, in order to ensure that the BLM references the most recent BA, the following mitigation measure has been developed:

- To protect special status fish and other aquatic organisms, implement all conservation measures for aquatic animals presented in the *Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States Biological Assessment* (USDOI BLM 2015).

Wildlife Resources

Introduction

Public lands sustain an abundance and diversity of wildlife resources. Over 3,000 species of wildlife occur on public lands, and are dispersed over ecologically diverse and essential wildlife habitats. Public lands are vital to big game, upland game, waterfowl, shorebirds, songbirds, raptors, and hundreds of species of non-game mammals, reptiles, and amphibians (USDOI BLM 2012a).

The BLM manages vegetation to improve wildlife habitat—areas where basic needs such as food, shelter, water, reproduction, and movement are met. Plants are an important component of habitat, providing food and cover for wildlife. Food is a source of nutrients and energy, while good cover prevents the loss of energy by providing shelter from extremes in wind and temperature. Cover also affords protection from predators. Areas that have been impacted by invasive plants may support fewer native wildlife species than areas with intact native plant communities (Germano et. al. 2001). The important characteristics of wildlife habitat in the eight ecoregions that comprise the treatment area are presented in the 2007 PEIS (USDOI BLM 2007a:3-36 to 3-43). Invasive plants can change habitat conditions by altering the structure of plant communities, creating conditions that are unfavorable for native wildlife species. For example, in an area dominated by cheatgrass, fires are high in frequency and have fewer unburned patches than in native communities, and can result in the loss of plant species that provide value for habitat, such as certain types of sagebrush (Miller et al. 2011). Areas dominated by invasive plants may also become less suitable for animal species that have co-evolved with native plant community types (Olson 1999b).

This section begins with an assessment of risks to general wildlife, including insects, birds, and small and large mammals, and is followed by an assessment of risks to special status wildlife species. Initial discussion in this section focuses on the risks to wildlife health from the use of herbicides, followed by an assessment of the risks and benefits to wildlife from treating vegetation in each ecoregion using the three new active ingredients, followed by an assessment of impacts to wildlife under each alternative.

Scoping Comments and Other Issues Evaluated in the Assessment

Most scoping comments pertaining to wildlife resources addressed the benefits to wildlife from using one or more of the three new active ingredients. Respondents stated that these herbicides have lower toxicity to wildlife than some of the herbicides currently being used. They also noted that these herbicides could be used to control noxious weeds and invasive species that alter habitats used by threatened and endangered wildlife species. In particular, one comment addressed the use of rimsulfuron to control cheatgrass in order to maintain viable habitat for sage-grouse and other shrub-steppe species.

The BLM also received a scoping comment requesting that the PEIS address potential sub-lethal effects to wildlife from the herbicides, reduced breeding/survival of sensitive species, secondary cumulative effects, and other unintended effects.

Standard Operating Procedures

The 2007 PEIS identified SOPs that minimize risks to wildlife from herbicide applications on public lands. These general procedures are designed to reduce the risk of unintended impacts to wildlife, and were taken into consideration when evaluating risks to wildlife from use of aminopyralid, fluroxypyr, and rimsulfuron:

- Use herbicides of low toxicity to wildlife.
- Use spot applications or low-boom broadcast applications, where possible, to limit the probability of contaminating non-target food and water sources, especially vegetation over areas larger than the treatment area.
- Conduct pre-treatment surveys for sensitive habitat and special status species within or adjacent to proposed treatment areas.
- Use timing restrictions (e.g., do not treat during critical wildlife breeding or staging periods) to minimize impacts to wildlife.

The 2007 PEIS also included several SOPs that have been developed to protect pollinators during herbicide treatments:

- Complete vegetation treatments seasonally before pollinator foraging plants bloom.
- Time vegetation treatments to take place when foraging pollinators are least active both seasonally and daily.
- Design vegetation treatment projects so that nectar and pollen sources for important pollinators and resources are treated in patches rather than in one single treatment.
- Minimize herbicide application rates. Use typical rather than maximum application rates where there are important pollinator resources.
- Maintain herbicide free buffer zones around patches of important pollinator nectar and pollen sources.

- Maintain herbicide free buffer zones around patches of important pollinator nesting habitat and hibernacula.

- Make special note of pollinators that have single host plant species, and minimize herbicide spraying on those plants (if invasive species) and their habitats.

A complete list of SOPs can be found in the 2007 PEIS (USDOI BLM 2007a:Table 2-8). Additional mitigation that was developed for wildlife resources and incorporated into the ROD for the 2007 PEIS is specific to the currently approved herbicides, and therefore is not repeated here. These measures would be applicable, however, for tank mixes or formulations that combine currently approved active ingredients with the new active ingredients.

Since the release of the 2007 PEIS, the White House released the National Strategy to Promote the Health of Honey Bees and Other Pollinators (White House Pollinator Health Task Force 2015). In this strategy, the BLM was tasked with taking steps to conserve and manage pollinators and pollinator habitat on public lands. Therefore, in addition to the pollinator SOPs listed in the 2007 PEIS, the BLM would follow appropriate BMPs for federal lands, as described at http://www.fs.fed.us/wildflowers/pollinators/BMPs/documents/PollinatorFriendlyBMPsFederalLandsDRAFT05152015.pdf). These include BMPs for pesticide use, which are similar to the pollinator SOPS listed above, as well as BMPs for improving pollinator habitat by removing invasive species, among others. During NEPA analysis for site-specific herbicide treatment projects, if impacts to pollinators are expected, the BLM would describe site-specific prescriptions to prevent those impacts.

Impacts Assessment Methodology

The methods used to assess impacts to wildlife from the three new herbicides were the same as the methods described in the 2007 PEIS (USDOI BLM 2007a:4-99 to 4-100). A brief overview of the risk assessment process is provided here, with a more detailed methodology presented in the risk assessments (AECOM 2014a,b; AECOM 2015).

Risk Assessment Methodology

Wildlife receptors, representing different categories of terrestrial animal species, were evaluated to determine the effects of herbicide exposure in terms of certain assessment endpoints and associated measures of effect. The assessment endpoint is an expression of the value that is to be protected. In the case of wildlife, assessment endpoints include mortality, growth, reproduction, and other ecologically-important sublethal processes. These assessment endpoints generally reflect direct effects on organisms, but indirect effects were also considered. Measures of effect are measurable changes in an attribute of an assessment endpoint (or its surrogate) in response to a stressor to which it is exposed (USEPA 1998b). For the ERAs, they generally consisted of acute and chronic toxicity data (from pesticide registration documents and from the available scientific literature) for the most appropriate surrogate species.

Because the BLM uses herbicides in a variety of programs with several different application methods, and because a range of wildlife species are found on public lands, the following exposure scenarios were considered to assess the potential ecological impacts of herbicides to wildlife under a variety of uses and conditions:

Direct spray of terrestrial wildlife:

- Small mammal – 100 percent absorption.

- Pollinating insect – 100 percent absorption.

- Small mammal – 1st order dermal absorption (absorption occurs over 24 hours, taking into consideration the potential for some herbicide to not be absorbed).

Indirect contact with foliage after direct spray:

- Small mammal – 100 percent absorption.

- Pollinating insect – 100 percent absorption.

- Small mammal – 1st order dermal absorption.

Ingestion of food items contaminated by direct spray:

- Small mammalian herbivore – acute and chronic exposure.

- Large mammalian herbivore – acute and chronic exposure.

- Small avian insectivore – acute and chronic exposure.

- Large avian herbivore – acute and chronic exposure.
- Large mammalian carnivore – acute and chronic exposure.

These exposure scenarios were considered as the most plausible routes for acute and chronic (short- and long-term) impacts under a variety of conditions. The selected receptors represent the range of wildlife species found on public lands, as well as the different feeding guilds that are present (herbivore, omnivore, and carnivore).

Exposure scenarios involving off-site drift, surface runoff, and wind erosion were not modeled for terrestrial wildlife because the direct spray scenarios were more conservative than scenarios involving wind erosion or runoff. Risk from consumption of food would be much greater if the food item was directly sprayed by an herbicide than if the herbicide drifted or was carried by water onto the food item.

Toxicological data for wildlife were extrapolated from data for representative or surrogate species. Data describing both acute and chronic effects were used to generate RQs for addressing potential risks to wildlife receptors (see the ERAs [AECOM 2014a,b; AECOM 2015] or the 2007 PEIS [USDOI BLM 2007a:4-100] for additional discussion of these calculations).

In order to address potential risks to wildlife receptors from exposure to herbicides, RQs were compared to levels of concern defined by the USEPA for screening the potential risk of pesticides. Distinct USEPA LOCs were used for acute and chronic risks, and for potential increased risks to special status species. For non special status wildlife, LOCs were 0.5 for acute risk and 1 for chronic risk. Wherever the RQ exceeded one or more of these LOCs, it was assumed that adverse toxicological effects to the wildlife group in question could occur. Corresponding levels of risk (low, medium, or high) were obtained by determining the factor by which the RQ exceeded the LOC.

Summary of Herbicide Impacts

The 2007 PEIS provides a discussion of the general risks to wildlife from herbicide use (USDOI BLM 2007a:4-101 to 4-102). Possible adverse direct effects include death, damage to vital organs, change in body weight, decrease in healthy offspring, and increased susceptibility to predation. Possible indirect effects include a reduction in availability of preferred food, habitat, and breeding areas; decrease in wildlife population densities within the first year following application as a result of limited reproduction; habitat and range disruption (as wildlife may avoid sprayed areas for several years following treatment), resulting in changes to territorial boundaries and breeding and nesting behaviors; and increase in predation of small mammals due to loss of ground cover (USEPA 1998c). Habitat modification is often the main risk to wildlife from herbicide use.

This effects analysis focuses on the effects of the three active ingredients proposed for use, in terms of toxicological effects to wildlife, effectiveness at controlling invasive species and improving habitat, and potential adverse effects to habitat.

As discussed in the 2007 PEIS, species that reside in an area year-round and have a small home range (e.g., insects, small mammals, and territorial birds) would be more at risk for adverse effects than more mobile species. In addition, species feeding on animals that have been exposed to high levels of herbicide could be impacted, particularly if the herbicide bioaccumulates in their systems. Although these scenarios were not modeled, wildlife could also experience greater impacts in systems where herbicide transport is more likely, such as areas where herbicides are aerially sprayed, dry areas with high winds, or areas where rainfall is high and soils are porous. Wildlife that inhabit subsurface areas (e.g., insects and burrowing mammals) may also be at higher risk if soils are non-porous and herbicides have high soil-residence times. The degree of interception by vegetation, which depends on site and application characteristics, would also affect direct spray impacts. The impacts of herbicide use on wildlife would primarily be site- and application-specific, and as such, site assessments would have to be performed at the field level, using available impact information, to determine an herbicide-use strategy that would minimize impacts to wildlife, particularly in habitats that support special status species.

Depending on the type of herbicide treatment, pollinators could benefit from or be adversely affected by treatments with herbicides. Treatments that remove non-native species that inhibit the growth of native plant species utilized by pollinators or limit native forb diversity would be expected to benefit pollinators. In the federal guidance document listing pollinator-friendly BMPs for federal lands, removal of invasive species is identified as an effective way to increase pollinator abundance and diversity. However, pollinators that utilize invasive plant species as food and nectar sources could be adversely affected by treatments that target these species, particularly if alternative habitat plants are not available nearby.

Based on risk assessments, aminopyralid, fluroxypyr, and rimsulfuron generally have very low risk to wildlife, and the most substantial effects would be associated with habitat modification.

Impacts of Aminopyralid

Aminopyralid would commonly be used on rangelands to manage undesirable broadleaf species. Therefore, wildlife most likely to be exposed to this active ingredient would include those that inhabit or feed on grasslands and grass-dominated shrublands, such as ground-nesting birds, ground-dwelling mammals, and large mammals that forage in these habitats, such as deer, elk, and pronghorn.

The risk assessment for aminopyralid predicted that exposure to this active ingredient would not pose a risk to terrestrial wildlife (including pollinators) under any of the modeled exposure scenarios (Table 4-12). Risk quotients were all below the LOC of 0.5 (acute high risk). Therefore, exposure of wildlife to this active ingredient by direct spray, contact with sprayed vegetation, or ingestion of plant materials or prey items that have been exposed to this active ingredient is not a concern from a toxicological perspective.

TABLE 4-12
Risk Categories Used to Describe Herbicide Effects on Non Special Status Wildlife According to Exposure Scenario

Application Scenario	Aminopyralid		Fluroxypyr		Rimsulfuron	
	Typ[1]	Max[1]	Typ	Max	Typ	Max
Direct Spray of Terrestrial Wildlife						
Small mammal – 100% absorption	0[2]	0	0	0	0	0
Pollinating insect – 100% absorption	0	0	0	0	0	0
Small mammal – 1st order dermal adsorption	0	0	0	0	0	0
Indirect Contact with Foliage After Direct Spray						
Small mammal – 100% absorption	0	0	0	0	0	0
Pollinating insect – 100% absorption	0	0	0	0	0	0
Small mammal – 1st order dermal absorption	0	0	0	0	0	0
Ingestion of Food Items Contaminated by Direct Spray						
Small mammalian herbivore – acute exposure	0	0	0	0	0	0
Small mammalian herbivore – chronic exposure	0	0	0	0	0	0
Large mammalian herbivore – acute exposure	0	0	0	0	0	0
Large mammalian herbivore – chronic exposure	0	0	0	0	0	0
Small avian insectivore – acute exposure	0	0	0	0	0	0
Small avian insectivore – chronic exposure	0	0	0	0	0	0
Large avian herbivore – acute exposure	0	0	0	0	0	0
Large avian herbivore – chronic exposure	0	0	0	0	0	0
Large mammalian carnivore – acute exposure	0	0	0	0	0	0
Large mammalian carnivore – chronic exposure	0	0	0	0	0	0

[1] Typ = Typical application rate; and Max = Maximum application rate.
[2] Risk categories: 0 = No risk (RQ < applicable LOC for non special status species).

The invasive species targeted by aminopyralid treatments, such as yellow starthistle, knapweeds, thistles, and tansy ragwort generally provide minimal value to wildlife, and are detrimental to wildlife habitat by forming monocultures that displace native species. Therefore treatments that target these species should benefit wildlife by improving habitat. The degree of benefit would vary by species of wildlife. Elk, for example, are adversely affected by spotted knapweed because they prefer the native grasses that it displaces, while deer are less affected because they eat more shrubs and other browse (Utah State University 2014). In grass-dominated habitats, aminopyralid has been shown to benefit ground-nesting birds and ground-dwelling mammals by controlling invasive broadleaf species while stimulating development of native grass species (Green et al. 2011; Halstvedt et al. 2011; Harrington et al. 2011).

As discussed in the Vegetation section, aminopyralid poses a risk to non-target native forbs and other desirable species in treatment areas, and therefore may have an adverse effect on wildlife habitat. Depending on the type of wildlife habitat and the size of the treatment area, temporary loss of herbaceous vegetation could have a short-term effect on broadleaf vegetation used by wildlife for food, cover, or nesting. Many native forbs, for example, provide important forage for wildlife, and may provide seeds that have higher energy content than foods provided by grass species (Kansas State University 1991). Native forbs also provide sources of pollen and nectar for certain native species of arthropods, and may serve as larval host plants.

In general, the long-term effects of removing invasive species from rangelands through aminopyralid applications would be to benefit native plant communities, improving wildlife habitat for numerous species in target areas.

Impacts of Fluroxypyr

Fluroxypyr would be used in very small quantities in the BLM's treatment programs, accounting for 1 percent or less of all herbicide treatment acres annually. Like aminopyralid, fluroxypyr would be used extensively in rangeland habitats, often in tank mixes, to manage invasive plants while maintaining grass forage species. Wildlife most likely to be exposed to this active ingredient would include inhabitants of grasslands and grass-dominated shrublands, including ground-nesting birds and ground-dwelling mammals. Large mammals that forage in these habitats would also have the potential to be impacted. Fluroxypyr would help manage invasive species that have developed a resistance to other herbicide active ingredients. Annual kochia and pricklypear are two of the target rangeland species identified by the BLM for this active ingredient. Both of these species provide some value for wildlife.

The risk assessment for fluroxypyr predicted that exposure to fluroxypyr would not pose a risk to terrestrial wildlife (including pollinators) under any of the modeled exposure scenarios (Table 4-12). Risk quotients were all below the LOC of 0.5 (acute high risk). Therefore, exposure of wildlife to this active ingredient by direct spray, contact with sprayed vegetation, or ingestion of plant materials or prey items that have been exposed to this active ingredient is not a concern from a toxicological perspective.

One identified use of fluroxypyr is to control pricklypear in desert habitats. Pricklypear provides shelter and food for a wide variety of wildlife species, including nesting habitat for birds, reptiles, and small mammals, and cover for northern bobwhite. Its fruits, seeds, and pads provide food for numerous species, including white-tailed deer and collared peccary (Ueckert 1997). Therefore, use of fluroxypyr to control pricklypear could have adverse impacts to certain wildlife, depending on the species and the intent of the treatment.

Impacts of Rimsulfuron

Rimsulfuron could potentially see widespread use on public lands, depending on which alternative is selected, primarily for management of cheatgrass, medusahead rye, and other invasive winter annual grasses. This active ingredient would be used in a variety of wildlife habitats currently degraded by invasive plants, including (but not limited to) grasslands, sagebrush-steppe, and woodlands. The goals of these treatments would be to both reduce the cover of the target species and reduce the risk of future wildfire. Given its widespread use, a wide variety of wildlife could be exposed to this active ingredient.

Possible modes of wildlife exposure to rimsulfuron include direct spray, dermal contact with treated vegetation, and ingestion of plant materials or prey items that have been exposed to the active ingredient. The risk assessment for rimsulfuron predicted that none of these exposure scenarios would pose a risk to any type of terrestrial wildlife (including pollinators; Table 4-12). Risk quotients were all below the LOC of 0.5 (acute high risk). Therefore, use of rimsulfuron on public lands does not present a toxicological concern for wildlife Because rimsulfuron would often be used to target large monocultures of cheatgrass and other invasive species, the short-term result of applications would likely be loss of vegetation and associated cover in treatment areas, which may constitute an impact to key habitat components for wildlife species. These short-term impacts should be offset by long-term improvements to habitat if treatment programs effectively reduce cover of target plant species and promote the establishment of native plant species. In some cases, post-treatment rehabilitation may be required.

While wildlife habitat on public lands has been adversely affected by displacement of native species by winter annual grasses, and associated reduced productivity, a potentially greater impact to wildlife habitat is the role of invasive plants in increasing the frequency and size of wildfires (Johnson and Davies 2012). Species like cheatgrass and medusahead rye form a dense layer of litter that decomposes slowly and is highly flammable (Pellant 1996, Johnson and Davies 2012). Therefore, even in situations where these target species offer some value as forage to wildlife, they increase the amount of fine fuels, resulting in hot, frequent wildfires. The invasion of cheatgrass onto the Intermountain rangelands, for example, has resulted in destructive wildfires that have negatively impacted wildlife and grazing resources (Clements et al. 2012; Clements and Harmon 2013). In addition to directly harming wildlife and their nests and food sources, and displacing them from burned habitats, fires can result in the long-term loss of key wildlife habitat components, such as big sagebrush.

The BLM currently uses approved active ingredients to control invasive annual grasses. The addition of rimsulfuron would offer the BLM more herbicide options for targeting these invasive species. Additionally, as discussed previously, there is some evidence that rimsulfuron may be less harmful to non-target species and promote the reestablishment of desirable native species. Therefore, use of rimsulfuron would likely provide some level of long-term benefit to wildlife habitat.

Impacts of Herbicide Treatments on Wildlife and Habitat by Ecoregion

The 2007 PEIS gives a description of impacts to wildlife habitat from herbicide treatment programs, by ecoregion (USDOI BLM 2007a:4-109 to 4-114). These discussions focus on treatment goals in each ecoregion, and how herbicide treatments to meet those goals could impact wildlife and their habitat found in each ecoregion. As the goals of herbicide treatments and the assumptions of future treatments identified by local BLM offices during preparation of the 2007 PEIS carry over to this PEIS, the wildlife impacts by ecoregion are still applicable and are not repeated here. The discussion in this section focuses on new information since the 2007 PEIS, and how use of aminopyralid, fluroxypyr, and rimsulfuron might change the way that herbicide treatment programs impact wildlife and their habitat in each ecoregion.

Tundra and Subarctic

Herbicides have not been used on public lands in Alaska on Arctic tundra or in subarctic forests, and herbicide treatments were not proposed for these regions as part of the BLM's vegetation treatment programs during preparation of the 2007 PEIS. However, the BLM has since come out with a *Draft Dalton Management Area Integrated Invasive Plant Strategic Plan* (USDOI BLM 2009c), which addresses control of invasive plants along the Dalton Highway and adjacent BLM-administered lands, along trails and spur roads, and at other heavy use areas (e.g., gravel pits, rest stops, mine sites, and airstrips). The release of this document indicates that some herbicide treatments are likely to occur in Alaska over the next 10 years, primarily to stop the spread of invasive plants from disturbed sites.

Based on the current information, herbicide treatments (including the currently approved herbicides and the three new herbicides) would have a minimal effect on wildlife and their habitat. The proposed uses of herbicides in these ecoregions are largely localized to roadsides and other areas subject to ongoing human disturbance, which are not prime habitat for wildlife (USDOI BLM 2013i). Furthermore, early control of new invaders will prevent the spread of these species into more pristine areas, thereby minimizing the risk of future impacts to wildlife habitat associated with noxious weeds and other invasive plant species. A total of 19 invasive plant species have been targeted for control in Alaska, including the nitrogen fixers white sweetclover, alfalfa, bird's-foot trefoil, and bird vetch, which could alter ecosystem processes and wildlife habitat in naturally nitrogen-poor areas.

Temperate Desert

The Temperate Desert Ecoregion would continue to receive the vast majority of herbicide treatments (an estimated 71 percent), with the goal of most treatments to restore lands damaged by fires in the Great Basin, and to benefit sage-grouse and other wildlife that use sagebrush communities.

Rimsulfuron, in particular, would be used extensively in the Temperate Desert Ecoregion, as a tool for controlling winter annual grasses such as cheatgrass and medusahead rye. Additionally, aminopyralid and fluroxypyr would be used, often in tank mixes with currently approved herbicides, to manage broadleaf rangeland weeds such as yellow starthistle, knapweeds, and annual kochia. Treatments with these herbicides would benefit a wide range of wildlife through habitat improvements with long-term goals of restoring native plant communities and reducing wildfire risk. Multiple treatments and post-treatment reseeding/restoration of native species would be necessary to meet these goals. Wildlife that would benefit from these treatments would include sage-grouse and shrub-dependent species. There are roughly 200 species of wildlife in the Great Basin (USDOI BLM 1999), many of which would likely benefit from herbicide treatments in the Temperate Desert Ecoregion.

Subtropical Desert

Treatments in the Subtropical Desert Ecoregion would continue to make up a small fraction (less than 1 percent) of the planned herbicide treatments. Therefore use of all herbicides, including the three new herbicides, would be minimal. Herbicide treatments in this ecoregion would continue to focus on managing woody species that have invaded shortgrass and mixed-grass prairies of the desert Southwest, including species such as mesquite, creosotebush, and snakeweed. These treatments benefit grassland-dwelling wildlife, such as jackrabbits, antelopes, and quail, by removing shrubs that have invaded these habitats and providing more open conditions (Germano 1978 *cited in* USDOI BLM 1991). For species that utilize shrubbier habitats, such as white-tailed deer, doves, and cottontail (McCormick 1975 *cited in* USDOI BLM 1991), herbicide treatments to control invading shrubs could have a negative effect on habitat.

Neither aminopyralid nor rimsulfuron has activity on the woody species that would be targeted for management in the Subtropical Desert ecoregion. Therefore, these herbicides would have little impact on wildlife habitat in this ecoregion. Fluroxypyr, however, provides control of undesirable woody species such as snakeweed and pricklypear, and could be used in limited amounts to control these species in the Subtropical Desert Ecoregion. Only a very small amount of this active ingredient would likely be used annually.

Temperate Steppe

Herbicide treatments in the Temperate Steppe Ecoregion would represent approximately 16 percent of all treated acres. More than three quarters of the herbicide treatments in this ecoregion would focus on management of invasive grasses and forbs, including cheatgrass, leafy spurge, and several species of knapweeds and thistles. Much of this work would be done in support of the BLM's Conservation of Prairie Grasslands initiative, and would benefit wildlife that inhabits short- and mixed-grass prairie grasslands, such as lesser prairie-chicken, mountain plovers, and prairie dogs.

Rimsulfuron is likely to be applied in wildlife habitat in this ecoregion because its predominant use would be control of cheatgrass. Aminopyralid has activity on knapweeds and thistles, and would provide the BLM with another option for management of these noxious weeds that alter the structure and species composition of prairie grasslands. Fluroxypyr would be used only minimally, but would be one option for controlling leafy spurge. While the BLM would be able to manage all of these invasive species with the currently approved active ingredients, the availability of aminopyralid would allow additional herbicide options when designing treatment programs to benefit wildlife habitat in the Temperate Steppe Ecoregion.

Subtropical Steppe Ecoregion

Herbicide treatments in the Subtropical Steppe Ecoregion would account for approximately 9 percent of all treatment acres. More than three-quarters of the treatments would occur in sagebrush and other shrub habitats, and 12 percent would occur in pinyon-juniper and other woodlands.

In sagebrush and pinyon-juniper communities, rimsulfuron would be available for use as another option for controlling infestations of cheatgrass and other winter annual grasses, and helping to reduce wildfire risk. Therefore, this active ingredient could be used instead of currently approved herbicides (primarily imazapic) in certain situations. None of the new herbicides, however, would play a role in treatments to thin sagebrush, pinyon and juniper, or other woody species in this ecoregion. Some control of broadleaf weeds could be offered by aminopyralid and rimsulfuron. Treatments with the new herbicides to control invasive plant species and reduce wildfire risk would provide a benefit to wildlife habitat.

Mediterranean and Marine Ecoregions

Herbicide treatments in the Mediterranean and Marine Ecoregions would represent approximately 5 percent of all treated areas. More than three-quarters of the treatments in these ecoregions would occur in forested habitats, and would be focused on integrated weed management and forest health. The objectives of forest health treatments would be to stem the decline in older forest habitats primarily due to fire exclusion, to restore more natural fire regimes, and to reduce hazardous fuels and the potential for catastrophic wildfires.

In forest and woodland habitats, the three new herbicides would be used to manage herbaceous invasive plant species that occur in the understory, or in canopy openings or disturbed areas, such as cheatgrass, knapweeds, and thistles. These treatments would be expected to improve habitat for forest- and woodland-dwelling wildlife by removing species that offer limited habitat value and displace higher value native forbs and grasses. Control of fire-adapted annual grasses in the understory would also help reduce fire risk in forest and woodland areas.

Impacts by Alternative

The following sections detail the expected effects of each of the four alternatives on terrestrial wildlife, and compare these effects to those expected under the other alternatives. These effects may vary depending on the percentage of acres treated using different application methods and different herbicides, as well as the size of treatment events. Earlier in this section, SOPs were described that would reduce some of the impacts described below.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under the No Action Alternative, the BLM would continue its ongoing vegetation treatment programs in 17 western states, using the 18 active ingredients currently approved for use. As estimated in the 2007 PEIS, approximately 7 percent of all treatment acres are associated with vegetation treatments that are done specifically to benefit wildlife and wildlife habitat. All treatments, however, would be likely to benefit wildlife habitat, as discussed in the previous section. A discussion of the benefits and impacts to wildlife is presented in the 2007 PEIS (Alternative B; USDOI BLM 2007a:4-115 to 4-116).

As identified in the 2007 PEIS, the currently approved herbicides of greatest concern to wildlife are 2,4-D, bromacil, diquat, and diuron, based on their relative level of risk to wildlife as predicted by ERAs. Based on the projections made in Table 2-4, treatments with these four active ingredients would comprise only about 10 percent of all acres treated under this alternative (compared to historic usage of about 13 percent). Other currently approved herbicides may pose low to moderate risk to wildlife under certain exposure scenarios.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, the total acreage of wildlife habitat treated with herbicides would be the same as under the No Action Alternative and the other action alternatives. Therefore, the degree of benefit to wildlife from treatment programs would be expected to be similar under all alternatives. The target species would be the same as under the No Action Alternative, as would treatment goals, including goals to improve wildlife habitat. The ability to use aminopyralid, fluroxypyr, and rimsulfuron under this alternative would allow the BLM greater flexibility in designing treatment projects, which could have a minor benefit to wildlife if it translates to more effective treatments and better achievement of project goals. The new active ingredients would provide new tools for controlling invasive species that may be resistant to one or more of the currently approved herbicides. Additionally, rimsulfuron would offer another option for wide-scale cheatgrass treatment, which currently threatens shrub-steppe and other important wildlife habitats throughout much of the western U.S.

Under this alternative, use of 2,4-D, bromacil, diquat, and diuron, when added together, would make up roughly 8 percent of all acres treated. Their usage would be slightly lower than under the No Action Alternative. However, all three of the new active ingredients proposed for use are of lower risk to wildlife than nearly all of the other active ingredients currently approved for use. Therefore, toxicological risks to wildlife would be lower overall under this alternative than under the No Action Alternative.

Alternative C – No Aerial Application of New Herbicides

Under this alternative, the total acreage of wildlife habitat treated with herbicides would be the same as under the other alternatives. Therefore, it is expected that the degree of benefit to wildlife from vegetation treatments programs would be similar to that under the other alternatives. Since the new herbicides would not be applied using aerial methods, their use would be limited to ground-based treatments. As a result, currently approved active ingredients would continue to be used in herbicide treatments that improve wildlife habitat through large-scale control of invasive plants.

The degree of benefit to wildlife habitat could be slightly lower than under the Preferred Alternative if the effectiveness of treatment programs is limited by the inability to utilize the new herbicides under aerial spraying scenarios.

The BLM may need to continue to use herbicides with a greater toxicological risk to wildlife instead of the three new herbicides proposed for use. Under this alternative, use of 2,4-D, bromacil, diquat, and diuron, when added together, would make up roughly 9 percent of all acres, which is slightly less than under the No Action Alternative, and slightly greater than under the Preferred Alternative. Both glyphosate and picloram, which would have greater use under this alternative than under the Preferred Alternative, have a greater toxicological risk to wildlife than the three new herbicides. Risks to wildlife from exposure to herbicides would be greater than under the Preferred Alternative but less than under the No Action Alternative.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under this alternative, the total acreage of wildlife habitat treated with herbicides would be the same as under the other alternatives, and the degree of benefit to wildlife from treatment programs would be similar under all alternatives. The inability to use rimsulfuron under this alternative would remove one option for treatment of invasives such as cheatgrass and other annual grasses. Control of these target species to improve wildlife habitat would continue with currently approved herbicides (such as imazapic). However, the effectiveness of treatments in certain areas could be lower than under the other action alternatives, particularly the Preferred Alternative.

Under this alternative, the currently approved active ingredients with the greatest toxicological risk to wildlife (2,4-D, bromacil, diquat, and diuron), when added together, would make up roughly 8 percent of all acres treated, which is the same as under the Preferred Alternative, and slightly lower than under the No Action Alternative and Alternative C. Relative to the Preferred Alternative, use of glyphosate and imazapic would be higher, similar to levels under the No Action Alternative. Relative to rimsulfuron, imazapic is of a similar toxicity to wildlife, so there would be little difference from a toxicological risk standpoint between the use of these two chemicals. Glyphosate, however, has a greater toxicological risk to wildlife than rimsulfuron. Therefore, risks to wildlife associated with exposure to herbicides could be slightly greater under this alternative than under the Preferred Alternative.

Mitigation for Herbicide Treatment Impacts

The BLM would continue to implement the SOPs identified earlier in this section, as well as all other SOPs identified in the 2007 PEIS (USDOI BLM 2007a:Table 2-8). These include, but are not limited to, timing restrictions to avoid critical wildlife breeding or staging periods and pre-treatment surveys for sensitive wildlife and their habitats. The mitigation measures for wildlife specified in the 2007 PEIS (USDOI BLM 2007a:4-118) would also apply to treatments involving the new herbicides, including applications of mixtures of the new herbicides with currently approved herbicides.

Given the low toxicological risk of aminopyralid, fluroxypyr, and rimsulfuron to wildlife, no new mitigation measures have been developed specific to these active ingredients.

Special Status Wildlife Species

Introduction

As discussed in Chapter 3, public lands in the western U.S. support over 200 species of terrestrial wildlife (including birds, mammals, amphibians, reptiles, mollusks, and arthropods) that have been given a special status based on their rarity or sensitivity. Included are more than 60 species that are federally listed as threatened or endangered, or are proposed for federal listing. Some of these species have habitat requirements that have been or are being altered or reduced by invasions of non-native plant species. The *Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States Biological Assessment* (USDOI BLM 2015) provides a description of the distribution, life history, and current threats for each federally listed animal species, as well as species proposed for listing. The BA also discusses the risks to federally listed and proposed terrestrial wildlife associated with each of the herbicides proposed for use by the BLM under the different alternatives.

Impacts Assessment Methodology

The BLM reviewed the literature and findings from ERAs conducted by the BLM to assess the impacts to

sensitive wildlife species from the use of herbicides (AECOM 2014a,b; AECOM 2015). The ERA methods are summarized in the Wildlife Resources section of this chapter, and are presented in more detail in the *Vegetation Treatments Programmatic EIS Ecological Risk Assessment Protocol* (ENSR 2004) and in Appendix C of the 2007 PEIS. To complete risk assessments for special status wildlife species, the chronic risk LOC of 1 and the acute endangered species LOC of 0.1 were used.

Summary of Herbicide Effects to Special Status Wildlife Species

A summary of the general effects of herbicide treatments on special status wildlife species and populations is presented in the 2007 PEIS (USDOI BLM 2007a:4-119 to 4-120). Use of herbicides can affect the habitats of special status wildlife species, as discussed for wildlife in general. Herbicide treatments would be expected to benefit species that are threatened because of noxious weeds and other invasive plant species. Invasive plant species typically reduce the prevalence of native plant species, many of which serve as the preferred food (or in some cases the only food) of special status wildlife species. Invasive species may also detrimentally affect other important habitat components such as structure for nesting, foraging, and cover. Herbicide treatments that reduce the cover of non-native species and increase the cover of native species would be expected to benefit these special status wildlife species.

Potential adverse effects to the habitat of special status wildlife species from herbicide treatments include removal of vegetation used for cover, nesting, or food, including unintentional removal of larval host plants and nectar sources for listed butterfly species.

The three new herbicides proposed for use by the BLM could pose toxicological risks to special status wildlife as a result of exposure via various pathways (direct spray, contact with foliage after direct spray, and ingestion of food items contaminated by direct spray). Based on information presented in the ERAs, aminopyralid and rimsulfuron would not pose toxicological risks to any special status wildlife under the modeled exposure scenarios. In the case of applications involving fluroxypyr, there would be a low risk to pollinating insects as a result of direct spray scenarios. This is a conservative scenario that assumes the insect absorbs 100 percent of the herbicide, with no degradation or limitations to uptake.

The potential for special status wildlife and their habitat to be exposed to herbicide treatments involving herbicides would be minimized by following applicable SOPs, which include the following:

- Survey for special status wildlife species before treating an area. Consider effects to these species when designing treatment programs.
- Use drift reduction agents to reduce the risk of drift hazard.
- Select herbicide products carefully to minimize additional impacts from degradates, adjuvants, inert ingredients, and tank mixtures.
- Avoid treating vegetation during time-sensitive periods (e.g., nesting and migration) for species of concern in the area to be treated.

Herbicide treatments would adhere to the most recent guidance for special status species, including land use plan decisions for sage-grouse as amended by pertinent sage-grouse EISs, and interim management direction as outlined in Instruction Memorandum 2012-043 (*Greater Sage-Grouse Interim Management Policies and Procedures*).

Impacts by Alternative

For the most part, the comparison of alternatives for special status wildlife is similar to that for all terrestrial wildlife, presented earlier in this chapter. While risk levels associated with fluroxypyr (presented in Table 4-13) are slightly higher for special status species than for non special status species, fluroxypyr treatments would make up only 1 percent or less of total herbicide use under all alternatives, and would only pose a risk to pollinating insects.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under this alternative, the BLM would continue its treatment programs with the currently available herbicides, treating up to 932,000 acres annually. Some of the treatments would be implemented specifically to benefit special status species and their habitat.

TABLE 4-13
Risk Categories Used to Describe Herbicide Effects on Special Status Wildlife According to Exposure Scenario

Application Scenario	Aminopyralid		Fluroxypyr		Rimsulfuron	
	Typ[1]	Max[1]	Typ	Max	Typ	Max
Direct Spray of Terrestrial Wildlife						
Small mammal – 100% absorption	0[2]	0	0	0	0	0
Pollinating insect – 100% absorption	0	0	**L**	**L**	0	0
Small mammal – 1st order dermal adsorption	0	0	0	0	0	0
Indirect Contact with Foliage After Direct Spray						
Small mammal – 100% absorption	0	0	0	0	0	0
Pollinating insect – 100% absorption	0	0	0	0	0	0
Small mammal – 1st order dermal absorption	0	0	0	0	0	0
Ingestion of Food Items Contaminated by Direct Spray						
Small mammalian herbivore – acute exposure	0	0	0	0	0	0
Small mammalian herbivore – chronic exposure	0	0	0	0	0	0
Large mammalian herbivore – acute exposure	0	0	0	0	0	0
Large mammalian herbivore – chronic exposure	0	0	0	0	0	0
Small avian insectivore – acute exposure	0	0	0	0	0	0
Small avian insectivore – chronic exposure	0	0	0	0	0	0
Large avian herbivore – acute exposure	0	0	0	0	0	0
Large avian herbivore – chronic exposure	0	0	0	0	0	0
Large mammalian carnivore – acute exposure	0	0	0	0	0	0
Large mammalian carnivore – chronic exposure	0	0	0	0	0	0

[1] Typ = Typical application rate; and Max = Maximum application rate.
[2] Risk categories: 0 = No risk (RQ < applicable LOC for special status species); and L = Low risk (RQ 1-10 times the applicable LOC for special status species).

Herbicides of greatest concern to special status wildlife from a toxicological perspective are 2,4-D, bromacil, diquat, diuron, glyphosate, hexazinone, and triclopyr. Based on their projected usage (summarized in Table 2-4), treatments with these active ingredients would total approximately 38 percent of all acres treated (compared to historic usage of about 44 percent). Out of these active ingredients, triclopyr, glyphosate, and 2,4-D would be used most widely, accounting for 33 percent of all acres treated. Other currently approved active ingredients may pose low to moderate risks to special status wildlife under a few exposure scenarios.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, efforts to improve habitats that support special status wildlife would benefit from the addition of aminopyralid, fluroxypyr, and rimsulfuron to the list of approved herbicides. These herbicides may improve the effectiveness of certain treatments, relative to treatments using the currently approved herbicides. Therefore, the degree of benefit to special status species may be slightly greater than under the No Action Alternative in certain situations.

In certain treatment projects, herbicides of low toxicity to special status wildlife would be used instead of herbicides with a higher risk. In particular, use of glyphosate would decrease by more than half. Herbicides of greatest concern from a toxicological perspective would account for about 30 percent of all acres treated, with use of 2,4-D, glyphosate, and triclopyr accounting for 26 percent of all acres treated. Therefore risks for adverse effects to special status wildlife associated with exposure to herbicides could be slightly lower than under the No Action Alternative.

Alternative C – No Aerial Application of New Herbicides

Under this alternative, treatments that improve habitats utilized by special status wildlife species through large-scale control of invasive plants would be accomplished using aerial spraying of currently approved herbicides, but not the new herbicides. This restriction would limit the benefits associated with introducing new herbicide options, relative to the Preferred Alternative.

Since the new herbicides would not be used in aerial applications, opportunities to use these active ingredients in place of those with a greater toxicological concern would be fewer than under the Preferred Alternative. Herbicides of greatest concern from a toxicological perspective would account for an estimated 35 percent of all acres treated, with use of 2,4-D, glyphosate, and triclopyr accounting for about 31 percent of all acres treated. Depending on where these herbicides are used, risks to special status wildlife from exposure to herbicides could be slightly lower than under the No Action Alternative but slightly higher than under the Preferred Alternative.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under this alternative, only two of the proposed active ingredients would be available for use under the BLM's herbicide treatment programs. Use of new active ingredients would be approximately the same as under Alternative C, although the breakdown by herbicide would be different. Programs aimed at improving habitat for special status wildlife species would be implemented without the option of rimsulfuron. The degree of benefit to special status species could be lower than under the Preferred Alternative if certain treatments are less effective without the option of rimsulfuron.

Under this alternative, based on herbicide usage estimates by the BLM, herbicides of greatest toxicological concern (2,4-D, glyphosate, and triclopyr) would account for approximately 36 percent of all acres treated, very similar to the No Action Alternative. Therefore, risks for adverse effects to special status wildlife would be similar to those under the No Action Alternative and slightly higher than under the other action alternatives.

Mitigation for Herbicide Treatment Impacts

Mitigation to reduce the likelihood of impacts to special status wildlife species, as included in the ROD for the 2007 PEIS, would continue to be implemented under all alternatives, as would all SOPs and mitigation for general wildlife species presented earlier in this section. These measures would be applied to treatments with the three new herbicides, as relevant.

The *Biological Assessment for Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States* determined that given the low toxicity of the three new active ingredients to most special status species and SOPs for minimizing risks to wildlife, no new conservation measures were necessary for herbicide treatments using aminopyralid or rimsulfuron (USDOI BLM 2015). For terrestrial arthropods, however, the BA recommended a conservation measure specific to use of fluroxypyr. Therefore, the following mitigation is recommended to reduce the likelihood of impacts to special status terrestrial wildlife species from herbicide applications.

- When conducting herbicide treatments in or near habitats used by special status and listed terrestrial arthropods, design treatments to avoid the use of fluroxypyr, where feasible. If pre-treatment surveys determine the presence of listed terrestrial arthropods, do not use fluroxypyr to treat vegetation.

While no additional mitigation measures specific to the three new herbicides were identified in the BA, conservation measures were developed for species that have been listed or proposed for listing since 2007. Therefore, the following mitigation measure has been developed to ensure that the new conservation measures in the 2015 BA are incorporated:

- To protect special status wildlife species, implement all conservation measures for wildlife presented in the *Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States Biological Assessment* (USDOI BLM 2015).

Additional evaluations of situation-specific effects to special status wildlife will occur prior to local implementation of vegetation management activities that involve the use of aminopyralid, fluroxypyr, and rimsulfuron. Additional measures to protect special status wildlife may be developed at that time.

Livestock

Introduction

Public lands provide an important source of forage for many ranches and help to support the agricultural component of many communities scattered throughout the West. Approximately 155 million acres of public lands are available to be grazed by livestock. Noxious weeds can affect the health of grazing lands by displacing native grasses and other plant species.

Additionally, certain noxious weeds are poisonous to livestock. Livestock that encounter noxious weeds may also contribute to the spread of noxious weeds on rangelands.

Scoping Comments and Other Issues Evaluated in the Assessment

Scoping comments directly pertinent to livestock and grazing included statements that the new herbicides are safe for use on grazing sites, and that aminopyralid in particular can be used in smaller amounts compared to currently approved herbicides.

A few comments, however, indicated that use of aminopyralid may be incompatible with grazing because of its persistence in vegetation. Comments noted incidents involving use of manure from animals that had grazed on vegetation treated with aminopyralid, which resulted in damage to crops and other non-target vegetation.

Standard Operating Procedures

The 2007 PEIS lists SOPs for minimizing risks to livestock, which can be implemented at the local level according to site conditions. These SOPs would apply to use of the new active ingredients, when relevant, to reduce potential unintended impacts to livestock from herbicide treatments:

- Whenever possible and whenever needed, schedule treatments when livestock are not present in the treatment area. Design treatments to take advantage of normal livestock grazing rest periods, when possible.

- As directed by the herbicide label, remove livestock from treatment areas prior to herbicide application, where applicable.

- Use herbicides of low toxicity to livestock, where feasible.

- Take into account the different types of application equipment and methods, where possible, to reduce the probability of contamination of non-target food and water sources.

- Notify permittees of the project to improve coordination and avoid potential conflicts and safety concerns during implementation of the treatment.

- Notify permittees of livestock grazing or feeding restrictions, if necessary (see below for restrictions associated with each herbicide).

- Notify adjacent landowners prior to treatment.

- Provide alternate forage sites for livestock, if possible.

The ROD for the 2007 PEIS (USDOI BLM 2007b: Table 2) also lists mitigation measures for livestock that are applicable to the currently approved herbicides. These measures could apply to the three new active ingredients if they are combined with one or more currently approved active ingredients in a formulation or tank mix.

Mitigation measures and SOPs would help minimize impacts to livestock and rangeland on western BLM lands to the extent practical. As a result, long-term benefits to livestock from the control of invasive species would likely outweigh any short-term negative impacts to livestock associated with herbicide use.

Impacts Assessment Methodology

The methods used to assess impacts to livestock from the three new active ingredients were the same as those described in the 2007 PEIS (USDOI BLM 2007a:4-125). Risk assessment results pertaining to mammalian receptors were used to assess impacts to livestock from the three new herbicides. The ERA methods are summarized in the Wildlife Resources section of this chapter, with a more detailed methodology presented in the ERAs. For dermal exposure scenarios, small mammals were used as receptors, as they are more likely to be affected than large animals (larger surface area to body weight ratio) and the results are more conservative. For ingestion scenarios, a large mammalian herbivore (mule deer) was used as the receptor in the risk assessment.

Summary of Herbicide Impacts

The 2007 PEIS (USDOI BLM 2007a:4-125 to 4-126) provides a discussion of the general effects of herbicide use on livestock. This information is summarized here, with more detailed discussion included for the three active ingredients specifically covered by this PEIS.

Possible direct effects from herbicides include death, damage to vital organs, change in body weight, decreases in healthy offspring, and increased susceptibility to predation. However, these effects are largely dependent on the quantity of the herbicide and the sensitivity of livestock to the herbicide used. Possible indirect effects include reduction in the amount of forage and the preferred forage type.

Beneficial effects to livestock could include an increase in desirable forage and a decrease in noxious weeds and other invasive species that constitute undesirable forage. Additionally, treatments that reduce the risk of future catastrophic wildfire through fuels reduction would also benefit livestock. Invasive plant species that may present a fire hazard in rangelands include cheatgrass, medusahead rye, other winter annual grasses such as ventenata and red brome, Russian thistle, oak, pinyon, and juniper.

Over the short term, there would be minor impacts to livestock rearing as a result of mandatory restrictions associated with the use of herbicides. These include restrictions on slaughter (for food) of animals that have consumed treated vegetation, as well as various grazing restrictions.

Noxious weed infestations can greatly reduce the land's carrying capacity for domestic livestock, which tend to avoid most weeds (Olson 1999a). Cattle, in particular, preferentially graze native plant species over weeds, which often have low palatability as a result of defenses such as toxins, spines, and/or distasteful compounds. In addition, some noxious weeds are poisonous to livestock. Although goats and sheep are more likely to consume alien weeds than cattle, they also tend to select native or introduced forage species over weeds (Olsen and Wallander 1997, Olson 1999a). The success of invasive plant species removal would determine the level of benefit of the treatments over the long term.

Livestock consume large amounts of grass, and therefore have a relatively greater risk for harm than animals that feed on other herbaceous vegetation or seeds and fruits, because herbicide residue is higher on grass than it is on other plants (Fletcher et al. 1994; Pfleeger et al. 1996). However, aminopyralid, fluroxypyr, and rimsulfuron generally have a very low risk to mammals, even when considering large herbivores and conservatively assuming that 100 percent of the animal's diet comes from treated vegetation. Therefore, the most likely effects would be associated with habitat modification and grazing restrictions.

Impacts of Aminopyralid

Aminopyralid is a selective herbicide that is used to control undesirable broadleaf plants in rangelands and pastures. Therefore, it is likely to be used in areas grazed by livestock.

The risk assessment for aminopyralid predicted that none of the possible scenarios of aminopyralid exposure (direct spray, contact with foliage after direct spray, ingestion of food items contaminated by direct spray) would pose a risk of adverse effects to livestock. As discussed previously, even scenarios that assume 100 percent of the diet comes from treated vegetation indicated no risk to livestock.

While aminopyralid is unlikely to adversely affect survival, growth, or reproduction of livestock, some restrictions in grazing would be necessary with the use of aminopyralid. Persistent herbicides are a class of systemic herbicides that are used to control a wide variety of broadleaf species. These herbicides are formulated to survive multiple years of exposure in a growing environment. The BLM would follow all label instructions when using herbicides. Aminopyralid is persistent in vegetation and does not break down in plants (Dow AgroSciences 2005), and therefore may be present in the urine or manure of livestock that have grazed in aminopyralid-treated rangelands. Therefore, after grazing aminopyralid-treated forage, livestock must graze for 3 days in an untreated pasture without desirable broadleaf plants before returning to an area where desirable broadleaf plants are present. There are no other restrictions on grazing following application of aminopyralid at the proposed typical or maximum application rate. If aminopyralid is used in a mixture with one or more other active ingredients, additional grazing restrictions may apply.

As discussed in the Vegetation section, aminopyralid has been observed to be successful at controlling unpalatable and/or poisonous rangeland weeds, such as musk thistle, yellow starthistle, knapweeds, and tansy ragwort. Russian knapweed and yellow starthistle, for instance, are known to be toxic to horses, causing "chewing disease" if large quantities are grazed over time, which can result in death if not treated (Turner et al. 2011). Tansy ragwort is toxic to various types of livestock, but particularly to cattle and horses. Ingestion of this noxious weed causes liver toxicity, and can result in death of animals that graze in fields where tansy ragwort is present (USDA Agricultural Research Service 2006).

Successful removal of these noxious weeds and restoration of grasses and other more palatable forage species would be beneficial to livestock. Aminopyralid is selective for broadleaf weeds, and therefore would not harm the native grasses that are favorable as forage for livestock.

Many forbs have a higher nutritional value than grasses, even though forbs make up a small percentage of the total cattle diet (Weir et al 2004). Non-target broadleaf species that would be adversely affected by an application of aminopyralid could include some of the most nutritionally valuable forage plants for livestock production. Therefore, while use of aminopyralid in rangelands could reduce the cover of noxious weeds and other unpalatable species, it could also reduce the amount of high quality forage (forbs) available to grazing animals (Weir et al. 2004).

Impacts of Fluroxypyr

Fluroxypyr is a selective herbicide that is used to control undesirable broadleaf plants while maintaining grass forage species. Therefore, fluroxypyr is likely to be used in rangelands that are grazed by livestock.

According to the risk assessment, fluroxypyr does not have a risk of causing adverse health effects to livestock as a result of dermal exposure or ingestion scenarios.

Fluroxypyr does not have any grazing restrictions for livestock, including lactating and non-lactating dairy animals. However, livestock must not eat treated forage for at least 2 days before slaughter for meat. If fluroxypyr is used in a mixture with one or more other herbicides, additional grazing restrictions may apply.

As discussed in the Vegetation section, fluroxypyr is effective at controlling pricklypear as well as other undesirable rangeland plants. Therefore, use of this herbicide could help improve the quality of rangeland forage, although its total annual use by the BLM would be low.

At high densities, pricklypear can interfere with forage utilization and livestock movement and handling. However, the fruits of the plant, in particular, are high in carbohydrates and very palatable to livestock. While the spines on plants are generally avoided, they may be ingested by hungry animals. Ingestion of spines can cause ulceration and bacterial infection of the mouthparts and gastrointestinal tracts of sheep and goats (Ueckert 1997). Therefore, control of pricklypear could have either adverse or beneficial effects on livestock forage, depending on how much of the species is controlled and what other forage is present on the site.

Impacts of Rimsulfuron

Rimsulfuron is a selective herbicide that is used to control winter annual grasses, such as cheatgrass and medusahead rye. It is approved for use on rangelands, and therefore is likely to be used in areas grazed by livestock.

According to the ERA, rimsulfuron does not pose a risk to mammals under any of the modeled exposure scenarios. These include scenarios involving direct spray, indirect contact with foliage after direct spray, and ingestion of food that has been treated with the active ingredient.

The label for rimsulfuron products includes a grazing restriction for range and pasture areas. No livestock grazing should occur on treated sites for 1 year following application, to allow newly emerged grasses sufficient time to establish.

Winter annual grasses reduce the quality of forage for livestock by displacing native grasses, and providing a very limited grazing season. Medusahead rye is rich in silica and becomes unpalatable to cattle and sheep in late spring (Oregon Department of Agriculture 2013). The seeds of cheatgrass produce stiff awns that make the plant unpalatable once the seed has dried. In Nevada, for example, the cheatgrass grazing season for livestock is only 4 to 5 weeks (University of Nevada Cooperative Extension 1998). Native perennial grasses stay green longer than invasive annual grasses, thus extending the grazing season (Griffith 2004). Additionally, cheatgrass increases the risk of wildland fire in rangelands, which would potentially affect livestock grazing in these areas. Nonetheless, cheatgrass is utilized as a forage species for livestock (Emmerich et al. 1993).

Impacts by Alternative

The potential effects to livestock under each alternative are discussed in the following sections. There are few differences among the alternatives, as the extent of herbicide treatment generally would be the same, with differences only in the relative percent of herbicides used.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

This alternative represents a continuation of current herbicide usage practices. The likely impacts of this alternative on livestock were presented in the 2007 PEIS, under the discussion for the Preferred Alternative (USDOI BLM 2007a:4-134; Tables 4-25 and 4-26). Both positive and negative effects to livestock are likely to continue under this alternative. Many of the currently approved herbicides are associated with some level of risk to livestock via one or more exposure pathways. The mitigation measures presented in the ROD for the 2007 PEIS (USDOI BLM 2007b:Table 2) would continue to be implemented to prevent adverse effects to livestock from herbicide applications in areas grazed by these animals.

Herbicide treatments under the No Action Alternative would continue to improve rangeland across the West. These treatments are controlling noxious weeds and limiting the risk of wildland fire, both of which should benefit livestock that use public lands. Multiple treatments and post-treatment reseeding/restoration of native species would be necessary to improve rangeland over the long term.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, the same total acreage would be treated using herbicides as under the No Action Alternative, except that aminopyralid, fluroxypyr, and rimsulfuron would be added to the list of approved active ingredients. Addition of the new herbicides would result in a shift in the relative amounts of the various herbicides that are used. However, only glyphosate, imazapic, and picloram would have a substantial reduction in usage under this alternative. Glyphosate and picloram are associated with low to moderate risks to livestock under various exposure scenarios (USDOI BLM 2007a:Table 4-26), but there is no risk to livestock associated with use of imazapic (USDOI BLM 2007a:4-129). Approximately 7 percent fewer acres would be treated with herbicides that have some level of risk to livestock.

Availability of the new herbicides would allow the BLM more flexibility in designing treatment programs, and could result in more successful treatment of rangelands utilized by livestock. Additionally, the new herbicides could be used in rangelands where livestock mitigation measures from the 2007 PEIS restrict use of other herbicides, to more effectively control rangeland weeds.

Alternative C – No Aerial Application of New Herbicides

Under this alternative, the three new herbicides would not be applied using aerial methods, and use of these chemicals would be lower than under the Preferred Alternative. Instead, other herbicides would be used for these large-scale treatments. As a result, approximately 5 percent fewer acres would be treated with herbicides that have some level of risk to livestock, relative to the No Action Alternative.

The BLM would be able to use the new herbicides in some areas where use of currently approved herbicides is limited by livestock mitigation measures from the 2007 PEIS, but not to the same degree as in Alternative B.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under this alternative, aminopyralid and fluroxypyr could be applied in rangelands via any application method, but rimsulfuron would not be added to the list of approved herbicides. Glyphosate and imazapic would continue to be used instead under most circumstances. Glyphosate is of low to medium risk to livestock, but imazapic poses no risk to livestock through the modeled exposure scenarios. Similar to the Preferred Alternative, approximately 7 percent fewer acres would be treated with herbicides that have some level of risk to livestock, relative to the No Action Alternative. While the BLM would not have rimsulfuron available for cheatgrass treatment programs in rangelands, this invasive rangeland species would continue to be controlled using imazapic and other active ingredients.

Mitigation for Herbicide Treatment Impacts

The BLM would continue to implement the SOPs identified earlier in this section, as well as all other SOPs identified in the 2007 PEIS (USDOI BLM 2007a:Table 2-8). Additionally, the mitigation measures for livestock that were specified in the ROD for the 2007 PEIS (USDOI BLM 2007b:Table 2) would continue to be followed, as applicable.

Given their low toxicological risks, no mitigation measures for livestock have been proposed specifically for herbicide treatments with aminopyralid, fluroxypyr, or rimsulfuron.

Wild Horses and Burros

Introduction

Herbicide treatments have the potential to affect wild horses and burros on BLM-administered lands through exposure to chemicals that could harm their health, or through changes in vegetation that could positively or negatively alter the carrying capacity of HMAs. Adverse impacts could include direct harm to wild horses and burros and a reduction in the availability or quality of forage in HMAs (decreasing the carrying capacity of the HMAs). Alternately, herbicide treatments could improve the amount and quality of forage, potentially increasing the carrying capacity of the HMAs.

Scoping Comments and Other Issues Evaluated in the Assessment

One scoping comment expressed concern about the toxicity of herbicides to wild horses and burros. No other scoping comments pertaining specifically to wild horses and burros were received.

Standard Operating Procedures

The 2007 PEIS lists SOPs for minimizing risks to wild horses and burros, which can be implemented at the local level according to specific conditions. These SOPs include the following:

- Use herbicides of low toxicity to wild horses and burros, where feasible.
- Remove wild horses and burros from identified treatment areas prior to herbicide application, in accordance with label directions for livestock.
- Take into account the different types of application equipment and methods, where possible, to limit the probability of contaminating non-target food and water sources.

The ROD for the 2007 PEIS (USDOI BLM 2007b: Table 2) also lists several mitigation measures for wild horses and burros that are applicable to the currently approved herbicides. These mitigation measures would be followed, as applicable, when using mixtures of currently approved herbicides and new herbicides. Additionally, the ROD specified that the herbicide label grazing restrictions for livestock should be applied to herbicide treatments in areas that support populations of wild horses and burros.

Impacts Assessment Methodology

The methods used to assess impacts to wild horses and burros from aminopyralid, fluroxypyr, and rimsulfuron were the same as those described in the 2007 PEIS (USDOI BLM 2007a:4-137). Risk assessment results pertaining to mammalian receptors were used to assess impacts to wild horses and burros. The ERA methods are summarized in the Wildlife Resources section of this chapter, with a more detailed methodology presented in the ERAs. For dermal exposure scenarios, small mammals were used as receptors, as they are more likely to be affected than large animals (larger surface area to body weight ratio) and the results are more conservative. For ingestion scenarios, a large mammalian herbivore (mule deer) was used as the receptor in the risk assessment.

Summary of Herbicide Impacts

The 2007 PEIS (USDOI BLM 2007a:4-137 to 4-138) provides a general discussion of the potential effects of herbicide use on wild horses and burros. This information is summarized here, with more detailed discussion included for the three active ingredients specifically covered by this PEIS.

Possible direct effects from herbicides include death, damage to vital organs, change in body weight, decreases in healthy offspring, and increased susceptibility to predation. However, these effects are largely dependent on the sensitivity of exposed animals to the herbicide used. Newborn horses and burros would be most susceptible to herbicides, with the March through June foaling season being a critical period. Possible indirect effects include reduction in the amount of forage and the preferred forage type. Additionally, wild horses and burros may move out of HMAs and onto lands that are not legally designated for wild horse and burro management.

Beneficial effects to wild horses and burros could include an increase in the treated area's carrying capacity for wild horses and burros with the removal of non-native, unpalatable species. Additionally, treatments that reduce the risk of future catastrophic wildfire through fuels reduction would also benefit wild horses and burros.

The three herbicides generally have a very low risk to mammals. Therefore, the most likely effects would be associated with habitat modification. Application of herbicides in HMAs would follow guidance in the BLM *Wild Horse and Burros Management Handbook* and associated Herd Management Plans (USDOI BLM 2010b).

Impacts of Aminopyralid

The risk assessment for aminopyralid predicted that none of the possible scenarios of aminopyralid exposure (direct spray, contact with foliage after direct spray, ingestion of food items contaminated by direct spray) would pose a risk to mammals. Therefore, aminopyralid does not pose a risk to wild horses and burros, even under the unlikely scenario that they would be directly sprayed during an herbicide application. The evaluated scenarios are very conservative because they assume 100 percent absorption of the active ingredient, and that 100 percent of the animal's diet comes from treated vegetation.

Wild horses and burros forage on grasses and forbs, but will also consume some shrubs. Based on a literature review of studies about the diets of wild horses and burros, these animals have a wide variation in diet depending on the habitat and what species are available (Abella 2008). While control of undesirable broadleaf plants by aminopyralid may improve forage for wild horses and burros, it may also reduce the availability of desirable forb species, as well as the diversity of forage species available. Currently, many HMAs are overburdened with wild horse and burro populations (USDOI BLM 2010b). Depending on the target species of the treatment, herbicide treatments with aminopyralid could improve the capacity of HMAs.

Impacts of Fluroxypyr

Based on the information in the ERA, there is no risk to mammals from exposure to fluroxypyr under the modeled dermal and ingestion exposure scenarios. Therefore, this herbicide is safe to apply in habitats used by wild horses and burros in standard BLM herbicide applications, even under direct spray scenarios and assuming that 100 percent of the animal's diet comes from treated vegetation.

Fluroxypyr would be used in tank mixes to help control undesirable rangeland plants. Depending on the target species, use of this herbicide could benefit the quantity and quality of forage in wild horse and burro HMAs.

Impacts of Rimsulfuron

According to the ERA for rimsulfuron, this active ingredient does not pose a risk to mammals under any of the modeled exposure scenarios. These include scenarios involving direct spray, indirect contact with foliage after direct spray, and ingestion of food that has been treated with the active ingredient. Therefore, this herbicide is safe to use in habitats where wild horses and burros occur and forage.

Rimsulfuron targets cheatgrass and other winter annuals. Wild horse and burros are known to feed on invasive annual grasses, although this may be based on availability rather than preference (Abella 2008). Treatments with rimsulfuron may improve forage for wild horses and burros over the long term by increasing the prevalence of more desirable perennial grasses. Additionally, control of fire-dependent winter annuals could decrease the occurrence of catastrophic fires that adversely affect HMAs (USDOI BLM 2010b).

Impacts by Alternative

The following sections discuss the expected effects of each of the four alternatives on wild horses and burros, and compare the effects expected under each alternative. These effects may vary depending on the acreage treated using different application methods and active ingredients, as well as the size of treatment events.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under this alternative, the 18 currently approved active ingredients would continue to be available for use in habitats used by wild horses and burros. Potential impacts to wild horses and burros associated with these active ingredients were assessed in the 2007 PEIS (USDOI BLM 2007a:4-138 to 4-143; Tables 4-25 and 4-26). As discussed in that analysis, the currently approved active ingredients have varying levels of risk to wild horses and burros, from no risk to high risk, under certain exposure scenarios for certain herbicides. The mitigation measures in the ROD for the 2007 PEIS (USDOI BLM 2007b: Table 2) were developed to minimize these risks, and would continue to be followed under this alternative.

Herbicide treatments with the currently approved active ingredients, as a component of larger vegetation treatments, would have a long-term positive effect on wild horse and burro communities through improvements in rangeland forage.

The focus of vegetation treatments would continue to be removal and control of invasive vegetation, and improvement of native shrubland and grassland communities. If effective, these treatments would benefit wild horse and burro habitat. Wild horses favor native grasses, including bluebunch wheatgrass, western wheatgrass, Indian ricegrass, and bluegrasses, and riparian/wetland vegetation, including sedges. Wild burros feed on a variety of plants, including grasses, Mormon tea, paloverde, and plantain. Treatments that improve range habitat should benefit these preferred plant species.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under the Preferred Alternative, the scope and extent of herbicide treatments would be similar to those under the No Action Alternative, but the three new active ingredients would be available for use as part of these treatments. The maximum assumed total area affected by herbicide treatments is the same as under the No Action Alternative and the other action alternatives (932,000 acres).

The three new active ingredients—aminopyralid, fluroxypyr, and rimsulfuron—are effective at controlling rangeland weeds, but have a low toxicity to mammals. These herbicides could potentially be used to improve habitat in areas used by wild horses and burros, where mitigation measures restrict or limit applications with other chemicals. Based on information provided by the BLM about the likely use of herbicides under this alternative (Table 2-4), glyphosate, imazapic, and picloram would see a substantial reduction in usage as a result of the addition of the three new herbicides. Of these, glyphosate and picloram are associated with low to moderate risks to wild horses and burros under various exposure scenarios, while imazapic does not present a risk. Compared to the No Action Alternative, approximately 7 percent fewer acres would be treated with herbicides that have some level of risk to wild horses and burros under the Preferred Alternative.

Because a similar acreage of land would be treated with herbicides under all of the alternatives, there would be few differences as far as long-term benefits to rangelands that support wild horses and burros. However, addition of the new herbicides under this alternative may allow the BLM to more effectively control invasive species and reduce fire risk in wild horse and burro habitats.

Alternative C – No Aerial Application of New Herbicides

This alternative is much like the Preferred Alternative as far as herbicide treatments in wild horse and burro habitats, except that aerial applications of the three new herbicides would be prohibited. For treatments requiring aerial applications, one or more of the currently approved herbicides would be used, similar to the No Action Alternative. Approximately 5 percent fewer acres would be treated with active ingredients that have some level of risk to wild horses and burros, relative to the No Action Alternative.

Long-term benefits to rangelands that support wild horses and burros would be similar to those under the other alternatives, as the acreage of land treated would be the same.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under this alternative, rimsulfuron would not be approved for use by the BLM, and would not be used in wild horse and burro habitats. Therefore, glyphosate and imazapic would continue to be used for most treatment programs (including cheatgrass treatments) that would incorporate rimsulfuron under Alternatives B and C. Glyphosate is of low to medium risk to wild horses and burros, but there is no predicted risk associated with use of imazapic. Similar to the Preferred Alternative, approximately 7 percent fewer acres would be treated with herbicides that have some level of risk to wild horses and burros, compared to the No Action Alternative.

Long-term benefits to rangelands that support wild horses and burros would be similar to those under the other alternatives, as the acreage of land treated would be the same.

Mitigation for Herbicide Treatment Impacts

The BLM would continue to implement the SOPs identified earlier in this section, as well as all other SOPs identified in the 2007 PEIS (USDOI BLM 2007a:Table 2-8). Additionally, the mitigation measures for wild horses and burros that were specified in the ROD for the 2007 PEIS (USDOI BLM 2007b:Table 2) would continue to be followed, as applicable.

Given their low toxicological risks, no mitigation measures for wild horses and burros have been proposed specifically for herbicide treatments with aminopyralid, fluroxypyr, or rimsulfuron.

Paleontological and Cultural Resources

Invasive plants are present at paleontological and cultural resource sites on public lands. Invasive plants can impact paleontological and cultural resources by displacing native plants and contributing to soil erosion. Removal of invasive vegetation, when done in such a way that the resources are not adversely affected, can contribute to the restoration and maintenance of historic and ethnographic cultural landscapes (USDOI National Park Service 2003).

Scoping Comments and Other Issues Evaluated in the Assessment

The BLM received a few comments addressing the potential impact of herbicide treatments on paleontological and cultural resources from tribes and SHPOs. There was a concern about potential impacts to culturally important plants that might be treated with the new active ingredients. One comment stated that to address such impacts, consultation with Indian nations should occur at the local level, once site-specific treatments are known. Additionally, local tribes should be contacted for information about traditional cultural properties and other culturally significant areas that might be impacted. Finally, one comment was concerned with negative impacts to historic buildings, monuments, and cemetery stones from nearby herbicide use.

Standard Operating Procedures

The 2007 PEIS documents the BLM's processes for identifying and managing paleontological, cultural, and subsistence resources (USDOI BLM 2007a:4-147 to 4-148). The BLM would continue to follow these processes and protocols for vegetation treatments involving aminopyralid, fluroxypyr, and rimsulfuron. These processes are outlined in a national Programmatic Agreement with the Advisory Council on Historic Preservation and the National Conference of State Historic Preservation Officers, state-specific protocol agreements with SHPOs, resource management plans, and numerous BLM handbooks.

Before proceeding with vegetation treatments, the effects of BLM actions on cultural resources would be addressed through compliance with the NHPA. Effects on paleontological resources would be addressed as outlined in resource management plans developed under the authority of the FLPMA and site-specific NEPA documents developed for vegetation treatments. The BLM's responsibilities under these authorities are addressed as early in the vegetation management project planning process as possible.

The BLM Cultural Resource Management program is responsible for the study, evaluation, protection, management, stabilization, and inventory of paleontological, historical, and archeological resources. The program also ensures close consultation with Native American tribal and Alaska Native group governments. The BLM initiated consultation with these groups to identify their cultural values, religious beliefs, traditional practices, and legal rights that could be affected by BLM actions. Consultation included sending letters to all tribes and groups that could be directly affected by vegetation treatment activities, and requesting information on how the proposed activities could impact Native American and Alaska Native interests, including the use of vegetation and wildlife for subsistence, religious, and ceremonial purposes (see Appendix B).

As discussed in the 2007 PEIS, paleontological, cultural, and subsistence resources within treatment areas would be identified at the local level, and site-specific mitigation measures would be developed during the implementation stage of vegetation treatments, if needed. Mitigation could include steps to avoid or protect cultural resources from treatments. In the case of subsistence resources, treatments may need to be modified or cancelled in certain areas to avoid impacts. Additionally, procedures to protect any cultural resources discovered during the course of vegetation treatments would be developed.

Additional SOPs that would apply to paleontological, cultural and subsistence resources are those pertaining to human health, which would apply to the safety of Native peoples who might visit areas targeted by treatments for subsistence, religious, or other traditional purposes. These procedures include (but are not limited to) posting treated areas with appropriate signs at common public access areas, observing restricted entry intervals specified by the herbicide label, and providing public notification in newspapers or other media when the potential exists for public exposure. Additionally, SOPs pertaining to fish, wildlife, and vegetation would help minimize potential impacts to subsistence resources.

Summary of Herbicide Impacts

The 2007 PEIS (USDOI BLM 2007a:4-148 to 4-149) provides a general discussion of the potential impacts of herbicide use on paleontological, cultural, and subsistence resources. This information is summarized in the sections that follow.

Paleontological Resources

Herbicides may have the potential to affect fossil materials, depending on: 1) fossil type; 2) minerals; 3) degree of fossilization; and 4) whether the fossil is exposed or buried. Herbicides may cause soil acidity to increase, or cause other chemical changes to fossil materials, such as discoloration or deterioration. More likely, damage to fossil materials, if present, would result from the use of wheeled equipment to apply herbicides, particularly vehicles traveling off roads, which could potentially crush fossil materials exposed on the surface. Additionally, herbicide treatments are more likely to affect researchers, students, or other field personnel conducting paleontological research than the paleontological resources themselves.

Cultural Resources

Herbicide treatments could potentially affect buried organic cultural resources, but would be most likely to have an effect on aboveground structures and traditional cultural practices of gathering plant foods or materials important to local tribes or groups. Some chemicals can cause soil acidity to increase, which would result in deterioration of artifacts—even some types of stone from which artifacts are made. Application of chemical treatments can also result in impacts such as altering or obscuring the surfaces of standing wall masonry structures, pictograph or petroglyph panels, and organic materials. One study of the effects of glyphosate and triclopyr on stone and masonry material found that both active ingredients resulted in salt formation and color change. Additionally, glyphosate can lead to a long-term increased rate of deterioration (Oshida 2011). No other active ingredients were included in the study, but it is assumed that other herbicides could adversely affect certain materials as well. While chemicals may affect the surface of exposed artifacts, these materials can generally be removed without damage if treated soon after exposure. Additionally, herbicide treatment SOPs include protocols for identifying cultural resources and developing appropriate measures to mitigate or minimize adverse impacts.

Organic substances used as inactive ingredients in herbicide formulations, such as diesel fuel or kerosene, may contaminate the surface soil and seep into the subsurface portions of a site. These organic substances could interfere with the radiocarbon or Carbon-14 (C-14) dating of a site (USDOI BLM 1991).

Subsistence Resources

Non-target plants affected by herbicide treatments may include species that are important to Native American tribes or Alaska Native groups for traditional subsistence, religious, or other cultural practices. Impacts to these resources would be avoided through local level consultation with tribes and groups to identify areas where plant resources of importance are located. The potential health risks associated with exposure to/consumption of plant materials with herbicide residues are discussed in the Herbicide Impacts on Native American Health section.

Treatments to control noxious weeds and other invasive species could benefit populations of native plant species used as subsistence or for other traditional practices, through restoration of native plant communities.

Fish and wildlife used for subsistence could be adversely affected through temporary displacement from treatment sites or exposure to herbicides. The Fish and Aquatic Invertebrates and Wildlife Resources sections provide more detailed information on potential effects to wildlife from herbicide treatments.

Herbicide Impacts on Native American Health

Risk Assessment Methodology

The potential risks to Native Americans from exposure to herbicides used in BLM programs were evaluated separately from risks to other public receptors (see Human Health and Safety section in this chapter). Native Americans could be exposed to higher levels of herbicides as a result of subsistence and cultural activities such as plant gathering and consumption of fish caught in local streams. Therefore, risk levels determined for Native American receptors reflect unique exposure scenarios as well as typical scenarios for public receptors, but with higher levels of exposure than public receptors.

The risk assessments assume that the Native American receptors (154-pound adult and 33-pound child) are exposed to herbicides via dermal contact with spray, dermal contact with sprayed foliage, ingestion of drinking water from a sprayed pond, ingestion of berries containing spray, dermal contact with water in a sprayed pond, and ingestion of fish from a sprayed pond. These exposure methods are discussed further in the following sections, with additional detail provided in the 2007 PEIS (USDOI BLM 2007a:4-149 to 4-150).

Dermal Contact

For scenarios involving dermal contact with sprayed vegetation, risk assessments assume the following:

- The 50th percentile surface area of the head, lower legs, forearms, and hands are exposed to the herbicide (884 square inches (in^2) for adults and 434 in^2 for children; USEPA 2004).
- Native American receptors contact foliage for 3 hours per day of subsistence activities (Harper et al. 2002).
- Herbicide is transferred from foliage to skin at a rate of 171 in^2/hour for adults and 56 in^2/hour for children (USEPA 2012e).

For scenarios involving swimming in a contaminated pond, the exposure time was assumed to be 2.6 hours per day (Harris and Harper 1997), for 70 days per year. The exposed surface area was assumed to be 2,790 in^2 for an adult swimmer and 1,023 in^2 for a child swimmer (USEPA 2004).

Ingestion

Risk assessments assume that adult Native Americans ingest 1 quart of water per day (Harper et al. 2002) from a sprayed pond, and Native American children consume half the adult rate, or 0.5 quart/day.

The berry ingestion scenario assumes that a Native American adult consumes 0.7 pound (lb)/day (Harper et. al. 2002) and a Native American child consumes 0.15 lb/day (per California Environmental Protection Agency [CalEPA] 1996).

The adult fish ingestion rate was assumed to be 2 lbs/day based on a high fish diet scenario (Harper et al. 2002). The high fish diet consists primarily of fish supplemented by big game; aquatic amphibians, crustaceans, and mollusks; small mammals; and upland game birds. For Native American children, the ingestion rate was scaled by body weight to 0.4 lb/day (per CalEPA 1996).

Since it is assumed that a pond used for swimming is also a source of drinking water, incidental ingestion of contaminated water during swimming was not evaluated separately; it is included in the drinking water scenario.

The methodology for estimating potential risk to human health from exposure to herbicides is discussed in the Human Health and Safety section, under the Human Health Risk Assessment Methodology subsection.

Human Health Risks Associated with the Three New Herbicides

Native American adults face the same risks that public receptors face, as well as additional risks associated with exposure to some herbicides as a result of unique subsistence practices or increased time spent in treated areas. The risks to public receptors are discussed in the Human Health and Safety section. As shown in Table 4-15, there are no risks to public receptors from exposures resulting from routine use (typical or maximum application rate) or accidental scenarios. Additionally, there are no risks to Native American adults or children under any of the modeled exposure scenarios. These results indicate that aminopyralid, fluroxypyr, and rimsulfuron do not pose an unacceptable risk to Native American receptors, even under worst-case accidental exposure scenarios.

See the Vegetation, Fish and Aquatic Invertebrates, and Wildlife Resources sections in this chapter for more information on the potential risks of the three new herbicides to resources used by Native Americans.

Impacts by Alternative

The following is a discussion of how risk from herbicides would vary under each herbicide treatment alternative. Under all alternatives, the maximum acreage treated annually is assumed to be the same, with only the relative amount of each active ingredient used varying among the different alternatives. Under all alternatives, the BLM would use herbicide treatments for resource benefit, which would have beneficial effects on native plants and wildlife used by Native American tribes. Additionally, under all alternatives herbicide usage in Alaska would remain low, estimated at a maximum of 1,000 acres per year. Under all alternatives, the BLM would collaborate with Native American tribes and Alaska Native groups to identify and protect culturally significant plants used for food, basket weaving, fibers, medicine, and ceremonial purposes, and would use minimal impact treatments where culturally significant species are known to occur.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under this alternative, only the 18 previously approved herbicides would be available for use. Risks to paleontological and cultural resources, and to human health would be the same as those discussed under Alternative B of the 2007 PEIS (USDOI BLM 2007a:4-151). There are risks to Native American adults associated with exposure to diquat when it is accidentally spilled or applied at the maximum rate (low risk), and with the consumption of fish contaminated with 2,4-D (high risk) or hexazinone (moderate risk). There are risks to Native American children associated with exposure to diquat when it is applied at the typical rate. There are also risks associated with berry picking in areas sprayed with diquat at the typical rate. Native American adults and children residing near the treatment area face additional risks (i.e., low risk from exposure to diquat when it is applied at the typical or maximum rate, and moderate risk from diquat when accidentally spilled; low risk from exposure to fluridone when it is accidentally spilled).

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, aminopyralid, fluroxypyr, and rimsulfuron would be available for use in herbicide treatment programs, and as a result, there would be lower usage of other herbicides, particularly imazapic, glyphosate, and picloram. All of these herbicides have no to low human health risks. Of the herbicides with higher human health risks, use of 2,4-D would be slightly lower than under the No Action Alternative (approximately 1 percent fewer acres treated), indicating that risks associated with consumption of fish contaminated by 2,4-D would also be slightly lower. Other herbicides associated with human health risks (diquat, fluridone, and hexazinone) would continue to make up a very small component of the total herbicide usage. Generally, human health risks to Native Americans would be similar to those under the No Action Alternative.

Alternative C – No Aerial Application of New Herbicides

Under this alternative, human health risks to Native American receptors would be similar to those under the Preferred Alternative and the No Action Alternative. The new herbicides would not be applied aerially, eliminating certain exposure pathways for Native American receptors. According to the HHRA, aerial application scenarios are generally associated with greater overall human health risks than ground-based methods. However, based on information for occupational receptors (see Table 4-14), risk levels for the three new herbicides are similar for aerial and ground applications. Additionally, restriction of aerial applications of the new chemicals would not reduce aerial spraying of herbicides, as different active ingredients would be used where aerial spraying is needed.

Under this alternative, herbicides with higher human health risks would be used at roughly the same levels as under the No Action Alternative, over approximately 1 percent more land area than under the Preferred Alternative. In general human health risks to Native American receptors would be similar to those under the other alternatives.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Herbicides (No Rimsulfuron)

Risks to Native American receptors from exposure to herbicides under Alternative D would be similar to those under the other alternatives. Rimsulfuron would not be used, and as a result the use of glyphosate and imazapic would be higher than under the other action alternatives (similar to the No Action Alternative). All three of these active ingredients pose no to low risk to Native American receptors, so there would be little difference, from a human health standpoint, associated with restricting the use of rimsulfuron. Use of 2,4-D under this alternative would be slightly lower than under the No Action Alternative and Alternative C (1 percent fewer acres), indicating that risks associated with consumption of fish contaminated by 2,4-D would also be slightly lower. In general, human health risks to Native Americans would be similar to those under the other alternatives.

Mitigation for Herbicide Treatment Impacts

The BLM would continue to follow all of the SOPs for herbicide treatments in the 2007 PEIS that apply to paleontological and cultural resources (USDOI BLM 2007a:Table 2-8). Additionally, the BLM would follow the mitigation measures identified in the ROD (USDOI BLM 2007b), which are specific to certain previously approved herbicides and would not apply to the new active ingredients (but would apply if a mixture with one or more of these previously approved herbicides is used).

Given the low toxicity of aminopyralid, fluroxypyr, and rimsulfuron to humans, no additional mitigation measures are recommended for herbicide treatments with these active ingredients.

Visual Resources

Visual resources consist of land, water, vegetation, wildlife, and other natural or manmade features visible on public lands. Vast areas of grassland, shrubland, canyonland, and mountain ranges on public lands provide scenic views to users of public lands. The vegetation of an area, including the presence of native species and noxious weeds, affects its scenic qualities. Herbicide treatments also affect the visual quality of the landscape to varying degrees by killing target vegetation and creating a more open, “browned” landscape. Scenic impacts from herbicide treatments are most likely to be associated with projects that 1) reduce the visual rating of the treatment site over the long term, or 2) result in short- or long-term degradation of high-sensitivity visual resources.

Scoping Comments and Other Issues Evaluated in the Assessment

No scoping comments specific to visual resources were received by the BLM. However, the visual quality of the landscape is seen as a component of public benefit, and management of public lands must take into account visual resources. Lands located in highly visible areas along roads typically provide this benefit to the largest segment of the population.

Standard Operating Procedures

The 2007 PEIS identified several SOPs that would help reduce the impact of herbicide treatments on visual resources:

- Minimize the use of broadcast foliar applications in sensitive watersheds to avoid creating large areas of browned vegetation.
- Consider the surrounding land use before assigning aerial spraying as an application method.
- Avoid aerial spraying near agricultural or densely populated areas, where feasible.
- At areas such as visual overlooks, leave sufficient vegetation in place, where possible, to screen views of vegetation treatments.
- Use SOPs that minimize off-site drift and mobility of herbicides (e.g., do not treat when winds exceed 10 mph; minimize treatment in areas where herbicide runoff is likely; and establish appropriate buffer widths between treatment areas and residences), to contain the visual changes to the intended treatment area.
- If the area is a Class I or II visual resource, ensure that the change to the characteristic landscape is low and does not attract attention (Class I), or if seen, does not attract the attention of the casual viewer (Class II).
- Lessen visual impacts by 1) designing projects to blend in with topographic forms; 2) leaving

some low-growing trees or planting some low-growing tree seedlings adjacent to the treatment area to screen short-term effects; and 3) revegetating the site following treatment.

- When restoring treated areas, design activities to repeat the form, line, color, and texture of the natural landscape character to meet established VRM objectives.

These SOPs are designed to minimize visual impacts associated with killing invasive plants and removing vegetation. Additional guidance is provided in BLM Manual Handbook H-8431-1, *Visual Resource Contrast Rating* (USDOI BLM 1986b). No additional mitigation for herbicide treatments was proposed in the 2007 PEIS or specified in the 2007 ROD.

BLM Assessment of Visual Resource Values

As discussed in BLM Handbook H-8410-1, *Visual Resource Inventory* (USDOI BLM 1986a), potential visual impacts from proposed activities must be assessed to determine whether the potential impacts will allow the management objective for the affected area to be met. A visual contrast rating is used, in which the project features are compared with the major features in the existing landscape, using basic design elements of form, line, color, and texture. This process is described in BLM Handbook H-8431-1, *Visual Contrast Rating* (USDOI BLM 1986b). Activities or modifications in a landscape that repeat the basic design elements are thought to be in harmony with their surroundings. Modifications that do not harmonize are said to be in contrast with their surroundings.

Visual resource assessments would be conducted at the project level to determine the potential impacts to visual resources associated with defined vegetation treatment projects.

Summary of Herbicide Impacts

As the overall vegetation treatment program is programmatic in scope, no visual contrast rating was conducted for the 2007 PEIS. It is expected that this sort of analysis would occur at the local level for site-specific herbicide treatment programs. Instead, the 2007 PEIS gave a general overview of how herbicide treatments affect the visual quality of treated areas (USDOI BLM 2007a:4-154). As the new active ingredients affect vegetation in the same general way as some of the currently approved active ingredients, the general impact analysis for herbicide use in the 2007 PEIS would continue to apply even with the addition of aminopyralid, fluroxypyr, and rimsulfuron to the list of approved active ingredients.

In general, herbicide treatments have short-term adverse effects and long-term positive effects on visual resources. Herbicide treatments create openings and patches of discolored vegetation that may contrast markedly from surrounding areas of green vegetation. However, these impacts would begin to disappear within one to two growing seasons in most landscapes. Over the long term, herbicide treatments would likely improve visual resources on public lands by removing infestations of invasive plants and rehabilitating degraded ecosystems. Native-dominated communities tend to be more visually appealing than plant communities that have been overtaken by noxious weeds or other undesired species. Additionally, control of species that serve as fuels for wildland fire would help reduce the size and intensity of future wildfires. A reduced risk of fire would benefit visual resources, as wildland fires substantially degrade the visual quality of natural areas.

Impacts by Alternative

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under the No Action Alternative, the BLM would continue to implement vegetation treatment projects using the herbicides currently approved under the ROD for the 2007 PEIS. As discussed in the 2007 PEIS, short-term adverse impacts to visual resources associated with herbicide use would continue to occur. The most dramatic effects would be seen in states with the most acres treated, such as New Mexico, Idaho, and Wyoming, and in project areas where large acreages are treated.

Herbicide treatments in drier states, such as New Mexico, Nevada, and Wyoming, could have a reduced visual impact relative to those in more lush states because visual color contrast between natural and "browned" treated areas would be less dramatic.

Landscapes containing a large component of invasive species often contrast with surrounding natural landscapes and have a negative visual impact. For example, cheatgrass often turns brown during summer, while native species usually remain green long into summer or fall. Over the long term, ongoing vegetation treatments under this alternative would have a positive impact on visual resources, as invasive plants and unwanted vegetation would be removed, and visually preferable native vegetation and ecosystems would become reestablished.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, impacts to visual resources would be much the same as those under the No Action Alternative. A comparable acreage of public lands would be impacted by vegetation treatments, and the geographic locations and size of treatments would be similar to those discussed under the No Action Alternative. It is possible that the availability of the three new active ingredients would result in some changes to treatments, but it is expected that these changes would be minor.

If vegetation treatments prove to be more effective as a result of being able to use aminopyralid, fluroxypyr, and rimsulfuron, there could be greater short-term visual impacts associated with removal of target vegetation. However, associated long-term benefits of recovery of native plant communities could also be greater.

Alternative C – No Aerial Application of New Herbicides

While aminopyralid, fluroxypyr, and rimsulfuron would not be applied aerially under Alternative C, the currently approved active ingredients would continue to be available for aerial applications. Therefore, the overall extent of aerial treatments with herbicides should not differ substantially from that under Alternatives A and B. The total acreage of public lands affected by herbicide treatments would be the same as under the other alternatives, and the geographic locations and size of treatments would be similar to those discussed under the other alternatives. Short-term impacts and long-term beneficial effects to visual resources would be similar to those under the other alternatives.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

While rimsulfuron would not be available for use under this alternative, the 18 currently approved active ingredients would be available for use, in addition to aminopyralid and fluroxypyr. The maximum total acreage of public lands affected by herbicide treatments would be the same as under the other alternatives, and the geographic locations and size of treatments would be similar. Therefore, short-term impacts and long-term beneficial effects to visual resources would be similar to those under the other alternatives

Mitigation for Herbicide Treatment Impacts

The BLM's SOPs for minimizing impacts to visual resources, listed earlier in this section, would continue to be implemented when conducting vegetation treatments. These SOPs would help reduce short-term impacts associated with all herbicides, including aminopyralid, fluroxypyr, and rimsulfuron.

No mitigation measures are proposed for visual resources.

Wilderness and Other Special Areas

Because of their special status, wilderness and other special areas have strict guidelines for vegetation treatments. These guidelines prohibit activities that degrade the quality, character, and integrity of these protected lands. Manipulation of vegetation through use of herbicides and other methods is generally not permitted, although there are exceptions in the case of emergencies (e.g., wildfire threatening non-federal lands), actions taken to recover a federally listed threatened or endangered species, control of non-native species, and restoration actions where natural processes alone cannot recover the area from past human intervention (USDOI BLM 2012e).

In WSAs, natural processes are relied on to maintain native vegetation and natural disturbance regimes. However, vegetation treatments, including herbicide applications, are allowed if they meet the non-impairment standard (i.e., temporary and not creating surface disturbance), or if they are conducted in emergency circumstances, to protect or enhance wilderness characteristics, are grandfathered uses or valid existing rights, or are done to recover a federally listed or candidate species (USDOI BLM 2012f).

There are no set restrictions on vegetation treatments in other types of special areas. However, the unique characteristics of these areas would be considered when preparing management plans for treatment activities.

Herbicides may be applied in wilderness and other special areas under circumstances described in local Resource Management Plans or relevant NEPA documents. Herbicide treatments could affect these areas by altering the existing plant species composition and structure, and altering the visual qualities of treated areas.

Scoping Comments and Other Issues Addressed in the Assessment

None of the scoping comments received by the BLM were specific to wilderness or other special areas.

Standard Operating Procedures

The 2007 PEIS identified several SOPs to reduce the risk of spreading noxious weeds, prevent the establishment of new invaders, and promote public awareness to be followed in wilderness areas and other special areas:

- Encourage backcountry pack and saddle stock users to feed their livestock only weed-free feed for several days before entering a wilderness area.
- Encourage stock users to tie and/or hold stock in such a way as to minimize soil disturbance and loss of native vegetation.
- Revegetate disturbed sites with native vegetation if there is no reasonable expectation of natural regeneration.
- Provide educational materials at trailheads and other wilderness entry points to educate the public on the need to prevent the spread of invasive plants.
- Use the “minimum tool” to treat noxious and invasive vegetation, relying primarily on use of ground-based tools, including backpack pumps, hand sprayers, and pumps mounted on pack and saddle stock.
- Use chemicals only when they are the minimum method necessary to control invasive plants that are spreading within the wilderness or threaten lands outside the wilderness.
- Give preference to herbicides that have the least impact on non-target species and on the wilderness environment.
- Implement herbicide treatments during periods of low human use, where feasible.
- Address wilderness and other special areas in management plans.
- Maintain adequate buffers for Wild and Scenic Rivers (¼ mile on either side of river, ½ mile in Alaska).

These SOPs would continue to apply to herbicide treatments involving the three new herbicides. No mitigation measures specific to wilderness or other special areas were identified in the 2007 PEIS. However, all pertinent mitigation in the Vegetation, Fish and Other Aquatic Resources, Wildlife Resources, Recreation, and Human Health and Safety sections would potentially be applicable to herbicide treatments in these areas.

Summary of Herbicide Impacts

The 2007 PEIS provides a general overview of the effects of herbicide treatments on wilderness and other special areas (USDOI BLM 2007a:4-156 to 4-157). The discussion addresses herbicide treatments in general, and does not include a discussion of impacts specific to any of the active ingredients currently approved for use.

In general, herbicide treatments in wilderness and other special areas would have short-term adverse effects and long-term positive effects on special status area values. Herbicide treatments could result in short-term closures of special areas, and in disturbance and removal of vegetation from treated areas. In the case of wilderness areas and WSAs, only treatments that improve the natural condition of these areas would be allowed. Furthermore, use of motorized equipment to apply herbicides would need to be authorized based on further site-specific NEPA and minimum requirements analysis, in accordance with BLM policy.

Long-term effects of treatments in special areas would be beneficial, as noxious weed infestations and risk of future catastrophic wildfires would be reduced in these areas. The reduction of hazardous fuels and noxious weeds on lands adjacent or near to special areas would provide long-term benefits by reducing the likelihood that noxious weeds would spread onto these unique areas, or that a catastrophic wildfire would burn through them, thus degrading their unique qualities. Herbicide treatments in wilderness areas and WSAs, if successful, would potentially improve the naturalness component of wilderness character.

Impacts by Alternative

Generally, there would be few differences between the alternatives as far as potential effects to wilderness and other special areas, as the extent of treatments in these areas would likely be the same under all the alternatives.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under the No Action Alternative, the BLM would continue its herbicide treatments in wilderness and other special areas with the 18 currently approved herbicides. For example, herbicide treatments would continue to be used to control incipient populations of noxious weeds and other invasive species in order to prevent the expansion of these populations in wilderness and other special areas. Additionally, the risk of wildland fire could be reduced in these areas. Therefore, treatments would benefit the targeted areas and help protect their unique qualities.

Special areas that receive herbicide treatments would continue to be affected by disturbance associated with access to the treatment site (particularly for repeat treatments), and by a temporary reduction in the "naturalness" of the treated area with the loss of target vegetation. Additionally, users of these areas might be impacted by short-term closures following herbicide applications (see the Recreation section for more information). In most cases, the benefits of eradicating noxious weeds and reducing the risk of wildland fire would outweigh the potential short-term effects of chemical treatments.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under the Preferred Alternative, effects to wilderness and other special areas would be similar to those under the No Action Alternative. Herbicide treatments in these areas would likely involve the three new active ingredients, as warranted, and could be more effective at controlling target species as a result. However, given that the overall method and extent of treating wilderness and species areas would be more or less the same as under the No Action Alternative, there would be only minor differences as far as effects to these areas.

The three new active ingredients are all of low risk to human health (see the Human Health and Safety section for additional information), with no risk to public receptors under routine or accidental exposure pathways. However, the active ingredients that are likely to decrease in usage as a result of adding the three new active ingredients also have low to no risk to human health. Therefore, there would be very little difference between the Preferred Alternative and the No Action Alternative as far as potential impacts to the health of users of wilderness and other special areas from herbicide treatments.

Alternative C – No Aerial Application of New Herbicides

While the three new herbicides would not be applied aerially under Alternative C, the total extent of aerial treatments using herbicides would be similar to that under Alternative B, as other herbicides could still be applied via this method. Overall, it is not expected that aerial applications would be used to target wilderness and other special areas, as treatments would generally not be this widespread. Impacts under this alternative would be similar to those under the other alternatives, with short-term adverse effects associated with treatments and long-term benefits associated with the removal of noxious weeds. Potential impacts to the health of users of wilderness and other special areas from herbicide treatments would also be similar to those under the other alternatives.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Rimsulfuron would not be used to treat vegetation under Alternative D, but treatments in wilderness and other special areas could be completed with any of the currently approved herbicides, aminopyralid, or fluroxypyr. The extent of treatments in wilderness and other special areas and the species targeted would be similar to those under the other alternatives. Therefore, effects to these areas would also be similar, with short-term adverse effects associated with treatments and long-term benefits associated with the removal of noxious weeds. Potential impacts to the health of users of wilderness and other special areas from herbicide treatments would also be similar to those under the other alternatives.

Mitigation for Herbicide Treatment Impacts

The BLM's SOPs for minimizing impacts to wilderness and other special areas, listed earlier in this section, would continue to be implemented when conducting vegetation treatments. These SOPs would help reduce short-term impacts associated with all herbicides, including aminopyralid, fluroxypyr, and rimsulfuron.

Mitigation measures that may apply to wilderness and special area resources are associated with human and ecological health and recreation. Please refer to the Vegetation, Fish and Other Aquatic Resources, Wildlife Resources, Recreation, and Human Health and Safety sections of this chapter. No mitigation measures are proposed specifically for wilderness or other special areas.

Recreation

In areas that support high recreation use, the goals of vegetation treatments include maintaining the appearance of the area and protecting visitors from the adverse effects of contact with noxious weeds and other invasive/unwanted species. In these areas, herbicide use is generally limited to spot treatments. However, larger herbicide treatments would be more likely with increasing distance away from high-use visitor areas. Thus, hikers, hunters, campers, horsemen, livestock owners, and users of plant resources for cultural, social, and economic purposes would be at the greatest risk of coming into contact with herbicide treatment areas.

Scoping Comments and Other Issues Evaluated in the Assessment

No scoping comments specific to recreation were received by the BLM.

Standard Operating Procedures

The 2007 PEIS presented several SOPs that the BLM follows to help minimize the negative impacts of herbicide treatments on recreation:

- Schedule treatments to avoid peak recreational use times, while taking into account the optimum management period for the targeted species.
- Notify the public of treatment methods, hazards, times, and nearby alternative recreation areas.
- Adhere to entry restrictions identified on the herbicide label for public and worker access.
- Post signs noting exclusion areas and the duration of exclusion, if necessary.
- Use herbicides during periods of low human use, where feasible.

These SOPs would continue to apply to herbicide treatments involving the three new active ingredients. Additionally, SOPs identified in the Human Health and Safety, Fish and Aquatic Resources, and Wildlife Resources sections would further reduce risks to recreationists and the resources they use.

Summary of Herbicide Impacts

The 2007 PEIS provides a general discussion of the potential effects of herbicide treatments on recreation (USDOI BLM 2007a:4-160 to 4-161). This general effects analysis would also apply to treatments involving the three new herbicides, and is briefly summarized here.

Herbicide treatments would have short-term negative impacts and long-term positive impacts on recreation. During treatments, there would be some scenic degradation, as well as distractions to users (e.g., noise from machinery). In addition, there would be some human health risks to recreationists associated with exposure to herbicides. These risks are discussed in more detail in the Human Health and Safety section. The three new herbicides generally pose very little risk to human health for public receptors, even under scenarios involving an accidental spraying by an herbicide, entering a treated area soon after herbicide application, or accidentally coming into contact with herbicides that have drifted downwind. Finally, some areas would be off-limits to recreation activities as a result of treatments, generally for a few hours or days, but potentially for at least one full growing season or longer depending on the treatment. In most cases, recreationists would be able to find alternative sites offering the same amenities, but a lessened experience could result if concentrated use occurred in these alternative sites.

Over the long term, herbicide treatments would have a positive effect on recreation through the removal of undesirable vegetation on treated lands. Herbicide treatments would likely return public lands to a more "natural" or desirable condition, which hikers and nature enthusiasts would likely value over degraded lands. In addition, the increased aesthetic value of treated sites would benefit most recreational users. Treatments to reduce fuels would reduce the risk of wildfire in or near recreation areas. Additionally, treatment of sites to restore native vegetation would enhance fish and wildlife habitat, to the benefit of hunters, birdwatchers, and other users of these resources.

Impacts by Alternative

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under the No Action Alternative, the BLM would continue its vegetation treatments with the 18 active ingredients that are currently approved for use. This alternative corresponds to the Preferred Alternative in the 2007 PEIS (USDOI BLM 2007a:4-162). The maximum acres of public lands treated with herbicides would remain at 932,000 annually, and the states with the most treatments would continue to include Idaho, Nevada, Wyoming, and New Mexico. While these states were estimated to account for 76 percent of treatment acres under this alternative, they accounted for only 18 percent of visitor days during 2012 (USDOI BLM 2012b). Therefore, it is likely that an extensive portion of the land affected by herbicide treatments would occur in areas with a relatively low density of recreational visitors.

Under this alternative, short-term impacts and long-term benefits would occur on up to 932,000 acres of lands annually. Depending on the success of treatments, it is expected that degradation of public lands from wildland fires and infestations of invasive plants would decrease, and recreational users would be able to have improved outdoor experiences.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

This alternative would allow aminopyralid, fluroxypyr, and rimsulfuron to be used in the BLM's herbicide treatment projects, allowing increased flexibility for meeting treatment objectives. The maximum land area treated and the states with the largest amount of treatment acres would be the same as under the No Action Alternative. Therefore, the nature, extent, and intensity of impacts to recreation would be similar to those under the No Action Alternative.

The long-term benefits associated with this alternative would also be similar to those under the No Action Alternative, given that the program goals and target species would not change. Allowing use of the three new herbicides could result in more effective treatments, which would have a slightly higher degree of benefit to recreation than under the No Action Alternative.

Alternative C – No Aerial Application of the New Herbicides

It is unlikely that aerial spraying would occur in high public use recreational areas under any of the alternatives. Although the new herbicides would not be applied aerially under Alternative C, aerial applications of currently approved herbicides would still occur in dispersed use areas at levels similar to those under the other alternatives. The maximum land area treated, and the states with the most treatment acres, would be the same as under the other alternatives. Therefore the nature, extent, and intensity of impacts to recreation also would be similar to those under the other alternatives.

The long-term benefits associated with Alternative C would be similar to those under the other alternatives, with a reduction in degradation of public lands used for recreation by invasive plants and wildland fire.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

While use of rimsulfuron would not be allowed under Alternative D, herbicide treatments would be completed with the 18 currently approved herbicides, as well as aminopyralid and fluroxypyr. The maximum land area treated and the states with the largest treatment acreage would be the same as under the No Action Alternative and all of the action alternatives. Therefore, impacts to recreational sites and recreational users would be similar to those under the other alternatives.

The long-term benefits to recreation under this alternative would also be similar to those under the other alternatives. Program goals and target species would not change, so the only differences would be in terms of the effectiveness of treatments. Rimsulfuron would not be available to treat cheatgrass, but other herbicides such as imazapic and glyphosate would. Depending on the location and type of treatment, these currently approved herbicides may be less effective than rimsulfuron at controlling annual grasses in certain scenarios.

Mitigation for Herbicide Treatment Impacts

The BLM's SOPs for minimizing impacts to recreation, listed earlier in this section, would continue to be implemented when conducting vegetation treatments. These SOPs would help reduce short-term impacts associated with all herbicides, including aminopyralid, fluroxypyr, and rimsulfuron.

Mitigation measures that may apply to recreational resources are associated with human and ecological health. Please refer to the Vegetation, Fish and Other Aquatic Resources, Wildlife Resources, and Human Health and Safety sections of this chapter. No mitigation measures that pertain specifically to recreation are proposed.

Social and Economic Values

Introduction

Herbicide treatments have the potential to affect people, communities, and economies in each of the 17 western states that could receive treatments. Public lands support ranching (grazing leases), mining, active and passive recreation opportunities, and a myriad of other activities that westerners rely on. In addition to these resource uses, public lands provide social values that may not be readily quantifiable. The large expanses of federal lands are a significant contributor to the open spaces that define the "sense of place" in many parts of the West. Therefore, actions that affect federal lands, such as the application of herbicides, have the potential to affect the economic and social environment of the region.

The type of social and economic analysis presented in this PEIS will be similar to what was provided in the 2007 PEIS. Given its programmatic nature, this PEIS will address only general effects and expected trends, with more detailed, site-specific analyses conducted at the local level during the development of herbicide treatment projects. Additionally, since the bulk of the analysis in the 2007 PEIS was general to herbicide treatments, and not specific to the herbicides being considered, much of the analysis is the same for treatments involving the three new herbicides. This information will be referenced and summarized, as appropriate, with additional discussion that involves any new information that is available.

Scoping Comments and Other Issues Evaluated in the Assessment

Several scoping comments were concerned with the potential economic impacts to home and commercial gardeners and composters associated with use of the new herbicides. Aminopyralid, in particular, was identified as a concern based on reports and personal observations about the persistence of this herbicide in manure, compost materials, and hay, and subsequent damage to crops where the contaminated materials were used. Additionally, a few comments cited potential damage to crops from movement of herbicides on windblown dust and off-site drift.

Other comments addressed the cost of the new herbicides relative to herbicides that are currently being used, and the cost of herbicide treatments in general, relative to other treatment methods. There was general support for aminopyralid, fluroxypyr, and rimsulfuron in terms of their effectiveness and the potential to reduce the cost of herbicide treatments.

As discussed in the 2007 PEIS (USDOI BLM 2007a:4-164), the interests of all stakeholders must be considered when planning treatment programs, and the alternative selected for implementation must balance out the interests of national and local stakeholders.

Standard Operating Procedures

The 2007 PEIS (USDOI BLM 2007a:4-164 to 4-165) lists SOPs that have been designed by the BLM to reduce potential adverse impacts to social and economic conditions from the application of herbicides:

- Consider surrounding land use before selecting aerial spraying as a treatment method, and avoid aerial spraying near agricultural or densely-populated areas.
- Post treated areas and specify reentry or rest times, if appropriate.
- Notify adjacent landowners prior to treatment.
- Notify grazing permittees of livestock feeding restrictions in treated areas if necessary, as per label instructions.

- Notify the public of the project to improve coordination and avoid potential conflicts and safety concerns during implementation of the treatment.

- Control public access until potential treatment hazards no longer exist, per label instructions.

- Observe restricted entry intervals specified by the herbicide label.

- Notify local emergency personnel of proposed treatments.

- Avoid aerial spraying during periods of adverse weather conditions (imminent snow or rain, fog, or air turbulence).

- During helicopter applications, apply herbicides at an airspeed of 40 to 50 mph, and at an elevation of about 30 to 45 feet above ground.

- Comply with herbicide-free buffer zones to ensure that drift will not affect crops or nearby residents/landowners.

- Use spot applications or low-boom broadcast applications where possible to limit the probability of contaminating non-target food and water sources, especially vegetation over areas larger than the treatment area.

- Consult with Native American tribes and Alaska Native groups to locate any areas of vegetation that are of significance to the tribe and that might be affected by herbicide treatments.

- Work with Native American tribes and Alaska Native groups to minimize impacts to vegetation of cultural significance to the tribes.

- To the degree possible within the law, hire local contractors and workers to assist with herbicide application projects.

- To the degree possible within the law, purchase materials and supplies, including chemicals, for herbicide treatment projects through local suppliers.

- To minimize fears based on lack of information, provide the public with educational information on the need for vegetation treatments and the use of herbicides in an IPM program for projects proposing local use of herbicides.

These SOPs would continue to apply to herbicide treatments involving the new chemicals. No additional mitigation for social and economic values were identified in the 2007 PEIS.

Impact Assessment Assumptions

This impact assessment generally makes the same assumptions that were discussed in the 2007 PEIS (USDOI BLM 2007a:4-165). Site-specific information on likely use of the three new herbicides is unavailable, and no information on specific application parameters will be included. Other assumptions include the following:

- Communities that are particularly dependent on a single industry (e.g., ranching and recreation-dependent communities) are more susceptible to the effects of herbicide use than other communities.

- The proposed use of the new herbicides would only apply to public lands.

- None of the alternatives would significantly affect ongoing, long-term trends such as the increasing demand for outdoor recreation or growth in urban, suburban and rural populations.

- Treatments involving the new herbicides would meet the project objective of improving the effectiveness of the BLM's vegetation treatment programs. In turn, the cost of wildland fire suppression and the loss of life and property would be reduced.

Summary of Herbicide Impacts

The 2007 PEIS provides a general discussion of the effects of herbicide treatments on social and economic values (USDOI BLM 2007a:4-165 to 4-166). These effects would continue to apply to herbicide treatments involving the three new herbicides. They generally include social effects deriving from perceptions of health and safety risks for different chemicals; the success or failure of treatments using different chemicals; economic effects associated with changes in range productivity, wildfire risk, and access or attractiveness for recreation activities, and associated changes in employment and income; and direct and indirect economic effects tied to the cost of applying the herbicides.

Impacts of Aminopyralid

The BLM estimates that the cost per acre to apply aminopyralid, based on the typical application rate of this active ingredient, would be $6.73 per acre. Therefore, aminopyralid would be relatively inexpensive to apply, based on a review of the range of costs for the currently approved active ingredients provided in Table 3-21 ($1 to $115 per acre).

Use of aminopyralid is a concern from an economic standpoint because of its persistence in plant materials. If manure or compost originating from plant materials that were previously treated with aminopyralid is used on personal or commercial crops, loss of broadleaf crops may occur. Incidents of crop and garden damage as a result of using organic matter with aminopyralid residues have been reported (Washington State University Extension 2011). In 2010, several farmers and gardeners in Washington State lost most of their vegetable crops as a result of herbicide residues from composted dairy manure (Oregon State University 2011). Therefore, this active ingredient can be associated with economic impacts to private landowners if not used in accordance with the label directions. The BLM would follow all label instructions to prevent impacts to crops and gardens associated with use of this herbicide, including restrictions on grazing where applicable. The BLM would not export manure, plant residues, or other materials that may be treated with aminopyralid for use as soil amendments.

Because aminopyralid is an active ingredient that targets broadleaf plants, it could be associated with damage to off-site crops as a result of herbicide drift. As discussed in the vegetation section, buffers would be required to prevent impacts to non-target plants, which would include commercial crops and other broadleaf plants. Therefore, the buffers specified in Table 4-8 would be applicable to treatments with aminopyralid that are near private lands.

Impacts of Fluroxypyr

According to estimates from the BLM, the cost per acre to apply fluroxypyr is $16.53, based on the typical application rate. It is relatively expensive, compared to the costs of the currently approved active ingredients (Table 3-21), but would only be used in small quantities.

Like aminopyralid, fluroxypyr targets broadleaf plants, and therefore may adversely affect nearby croplands and other private lands as a result of herbicide drift. As discussed in the Vegetation section, buffers would be required to prevent impacts to non-target plants, which would include commercial crops and other broadleaf plants. Therefore, the buffers specified in Table 4-8 would be applicable to treatments with aminopyralid in the vicinity of private lands.

Impacts of Rimsulfuron

The BLM estimates that the cost per acre to apply rimsulfuron, based on the typical application rate of this active ingredient, would be $2.81 per acre. It is relatively inexpensive, compared to the costs associated with the currently approved active ingredients (Table 3-21). Rimsulfuron is substantially cheaper than imazapic, which costs $10 to $15 per acre, depending on the mode of application.

Rimsulfuron has activity on annual plants, and could harm certain crops and other non-target plants grown commercially. Buffers would be required to prevent impacts to non-target plants on private lands, as discussed in the Vegetation section and Table 4-8, to reduce the potential for adverse economic effects to nearby landowners.

Impacts by Alternative

Impacts Common to All Alternatives

The 2007 PEIS (USDOI BLM 2007a:4-171) includes a substantial discussion on the impacts of herbicide treatments on population and demography, environmental justice, protection of children, employment and income, perceptions and values, invasive species control cost savings, wildland fire cost savings, economic activity and public revenues generated from BLM lands, expenditures by the BLM, and effects on private property. Because the three new active ingredients would be incorporated into larger herbicide treatment programs, with the same maximum acreage assumed, these general impacts associated with herbicide treatments would continue to occur. Differences would be limited to which active ingredients would be used. These differences are captured in the earlier discussion specific to each of the three new active ingredients, as well as in the discussions for each of the alternatives.

Under all alternatives, herbicide treatments could occur on public lands near minority or low-income populations. As discussed in the 2007 PEIS (USDOI BLM 2007a:4-167), it is not possible to determine whether these populations would be disproportionately affected at the broad scale of analysis in this PEIS. Specific evaluation of environmental justice impacts would be conducted in concert with environmental analyses for site-specific treatment project proposals. Additionally, ongoing consultation and close communication with Indian tribes about the locations and timing of future herbicide treatments would continue to address potential impacts to Native American populations.

Impacts of Individual Alternatives

Alternative A – Continue Present Herbicide Use (No Action Alternative)

This alternative corresponds to the Preferred Alternative under the 2007 PEIS (USDOI BLM 2007a:4-172 to 4-173). Herbicide treatments would occur on up to 932,000 acres annually in 17 western states, and would include only the 18 currently approved herbicides. These treatment levels would be much the same as at present, so there would likely be little change to existing patterns and trends in population or demographic conditions in the western U.S. Additionally, no changes in employment associated with herbicide treatment would occur.

Herbicide treatments would continue to generate some employment in geographic areas affected by the treatments, but the jobs would generally be short-term, temporary positions or contracted work, which do not encourage in-migration of workers and their families.

Herbicide treatments would take place on public lands, away from areas where children are known to congregate, such as schools and playground. While children may visit public lands or live in the vicinity, they are unlikely to make up a disproportionate percentage of nearby populations or visitors to public lands. Buffers between residences and treatment areas and advance communication of treatments and site closures would minimize risks to children. Therefore, disproportionate impacts to children should not occur.

The 2007 PEIS estimated the costs to treat vegetation under the Preferred Alternative (USDOI BLM 2007a:4-172), which corresponds to the No Action Alternative for this PEIS. This estimate is based on a maximum total annual treatment area of 932,000 acres. While the BLM's current levels of treatment are much lower, this PEIS assumes that the assumptions for treatment acres in the 2007 PEIS will carry forward. Assuming this maximum acreage and inflation costs of approximately 3 percent per year since 2007, the estimated costs to treat vegetation using herbicides would be approximately $110 million per year.

Herbicide treatments that reduce fire risk would continue to be associated with cost savings associated with reduced need for wildland fire suppression and reduced loss of property. These savings cannot be quantified. Herbicide treatments would also help reduce the spread of noxious weeds, which would provide some level of economic benefit by reducing the future costs of vegetation management.

Commercial activities that occur on public lands, such as timber sales, grazing, and recreation would continue to be impacted a minor amount by herbicide treatments. Additionally, there would continue to be a risk for herbicide treatments to impact private property, which could result in damage to crops or other non-target plants of commercial value.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under the Preferred Alternative, the total acres treated with herbicides each year would be the same as under the No Action Alternative. However, the breakdown in use of the various active ingredients would change with the introduction of aminopyralid, fluroxypyr, and rimsulfuron. Under this alternative, there would be a substantial reduction (by approximately 21 percent) in the use of glyphosate, imazapic, and picloram, and the new active ingredients aminopyralid and rimsulfuron would make up approximately 26 percent of herbicide use, based on acres treated. Fluroxypyr, though relatively expensive, would only constitute approximately 1 percent of all acres treated. Glyphosate, imazapic, and picloram are more expensive than aminopyralid and rimsulfuron. Therefore, the estimated costs to treat vegetation with herbicides (based on the cost and projected future use of each active ingredient) would be lower under this alternative than under the No Action Alternative. The estimated reduction in herbicide costs is 1 to 2 percent per year.

In most other regards, the potential social and economic impacts associated with herbicide treatments would be similar to those under the No Action Alternative. While there could be minor differences in the effectiveness of certain herbicide treatments with the availability of the new active ingredients, these differences would not reflect measurable changes in socioeconomic impacts.

No changes in populations and demography, or employment, would occur. The potential for disproportionate adverse effects to minority populations and children would continue to be low. The level of economic benefit associated with fuels reduction and control of noxious weeds would be similar to that under the No Action Alternative, as would the level of risk to commercial activities on public lands and adjacent private properties.

This alternative would allow the use of aminopyralid, which is of concern from an economic standpoint for its potential to damage crops and gardens if used inappropriately. However, the currently approved herbicides clopyralid and picloram are also pyridine carboxylic acids with a similar residual activity in manure and plant materials. While total use of this class of herbicides would increase by approximately 7 percent relative to the No Action Alternative, in all cases, risks could be avoided by adhering to the restrictions on the herbicide label.

Alternative C – No Aerial Application of New Herbicides

Under Alternative C, the total acres treated with herbicides each year would be the same as under the other alternatives, and the list of active ingredients used would be the same as under the Preferred Alternative. However, the relative amount used would vary somewhat because the three new active ingredients would only be applied using ground methods, and could not be utilized in aerial-based herbicide treatments. Under this alternative, there would be a smaller reduction in use of more expensive active ingredients, as less of the new active ingredients would be used than under the Preferred Alternative. Costs to treat vegetation using herbicides (based on the cost and projected future use of each active ingredient) would likely decrease, but by a lesser amount, estimated at less than 1 percent per year.

Other social and economic impacts associated with herbicide treatments would be similar to those under the other alternatives. No changes in populations and demography, or employment, would occur. The potential for disproportionate adverse effects to minority populations and children would continue to be low. The level of economic benefit associated with fuels reduction and control of noxious weeds would be similar to that under the other alternatives, as would the level of risk to commercial activities on public lands and adjacent private properties.

This alternative would entail slightly less use of aminopyralid than under the Preferred Alternative, but total use of the three pyridine carboxylic acids of particular concern would be approximately 1 percent less than under the Preferred Alternative. In all cases, risks could be avoided by adhering to the restrictions on the herbicide label.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under Alternative D, the maximum acreage treated with herbicides each year would be the same as under the other alternatives. The list of active ingredients would be different than under the other alternatives, however, as aminopyralid and fluroxypyr would be approved for use and rimsulfuron would not. Under this alternative, there would be very little reduction in the use of glyphosate and imazapic, but a substantial reduction in the use of picloram. Costs to treat vegetation using herbicides would not decrease by a substantial amount, relative to the No Action Alternative. The herbicide cost reduction is estimated at a fraction of a percent per year, much lower than under Alternatives B and C.

Other social and economic impacts associated with herbicide treatments would be similar to those under the other alternatives. No changes in populations and demography, or employment, would occur. The potential for disproportionate adverse effects to minority populations and children would continue to be low. The level of economic benefit associated with fuels reduction and control of noxious weeds would be similar to that under the other alternatives, as would the level of risk to commercial activities on public lands and adjacent private properties.

Use of aminopyralid under Alternative D would be the same as under the Preferred Alternative, and total use of the three pyridine carboxylic acids of particular concern would also be the same as under the Preferred

Alternative. In all cases, risks could be avoided by adhering to the restrictions on the herbicide label.

Mitigation for Herbicide Treatment Impacts

The SOPs listed earlier in this section were designed to reduce potential adverse impacts to social and economic conditions from the application of herbicides. They would apply to all treatments involving aminopyralid, fluroxypyr, and rimsulfuron.

No mitigation measures are proposed for social and economic resources.

Human Health and Safety

The use of herbicides involves potential risk or the perception of risk to workers and members of the public living or engaging in activities in or near herbicide treatment areas. As part of the PEIS, an HHRA has been conducted to evaluate the potential human health risks of aminopyralid, fluroxypyr, and rimsulfuron as a result of herbicide exposure during and/or after treatment of public lands. The HHRA has been conducted to be scientifically defensible, to be consistent with currently available guidance where appropriate, and to meet the needs of the BLM vegetation treatment program.

The three new active ingredients may be used with one or more previously approved active ingredients, either as a formulation or a tank mix (see Section on Herbicide Formulations Used by the BLM and Tank Mixes in Chapter 2). The human health risks associated with the currently approved herbicides may be found in the 2007 PEIS (USDOI BLM 2007a:4-182 to 4-194). Only the three herbicides proposed for use are considered in this PEIS.

Scoping Comments and Other Issues Evaluated in the Assessment

The BLM received a few scoping comments expressing concerns about the health risks associated with herbicides. In particular, one comment stressed the need for additional preventative measures and oversight of existing SOPs to protect human health, after reports that an individual was sprayed during an aerial herbicide application, and was not notified beforehand that the treatment would occur. Another comment indicated that the existing buffers between treatments and human habitation are not adequate. However, one comment also pointed out that risks associated with herbicides should be considered alongside the risks associated with other types of vegetation treatments that would be used if herbicides were not allowed. None of the comments specifically addressed the three active ingredients that are being considered in this PEIS.

Standard Operating Procedures

The 2007 PEIS lists SOPs that were designed by the BLM to reduce potential unintended impacts to human health from the application of herbicides. These SOPs would continue to apply to herbicide treatments involving aminopyralid, fluroxypyr, and rimsulfuron, and are considered when evaluating impacts to human health and safety:

- Establish a buffer between treatment areas and human residences based on guidance given in the HHRA, with a minimum buffer of ¼ mile for aerial applications and 100 feet for ground applications, unless a written waiver is granted.
- Use protective equipment as directed by the herbicide label.
- Post treated areas with appropriate signs at common public access areas.
- Observe restricted entry intervals specified by the herbicide label.
- Provide public notification in newspapers or other media where the potential exists for public exposure.
- Have a copy of SDSs/MSDSs at work sites.
- Notify local emergency personnel of proposed treatments.
- Contain and clean up spills and request help as needed.
- Secure containers during transport.
- Follow label directions for use and storage.
- Dispose of unwanted herbicides promptly and correctly.

The results from the HHRA will help inform BLM field offices about the proper application of herbicides to ensure that impacts to humans are minimized to the extent practical.

Human Health Risk Assessment Methodology

The HHRA for aminopyralid, fluroxypyr, and rimsulfuron follows the same methodology as the HHRA for the 2007 PEIS (USDOI BLM 2007a:4-175 to 4-181), as discussed in detail in the HHRA. This methodology is summarized here.

The BLM HHRA follows the four-step risk assessment model identified by the National Academy of Sciences (1983). The steps are: 1) hazard identification, 2) dose-response assessment, 3) exposure assessment, and 4) risk characterization.

Hazard Identification

The hazard identification section provides information on the herbicide active ingredient characteristics and usage, and toxicity profiles. Both acute (short-term) and chronic (longer-term) toxicity information is considered. Acute toxicity endpoints include oral, inhalation, and dermal acute toxicity; eye irritation; skin irritation; and dermal acute toxicity. Acute toxicity endpoints include the median lethal dose (the dose that kills 50 percent of test animals), the dose at which no adverse effects were seen, and the lowest level at which adverse effects were seen.

Inert ingredients were considered in the HHRA for the 2007 PEIS. As the inert ingredients found in formulations of the three new herbicides would be the same as those previously considered, no additional analysis of these chemicals was done in the current HHRA. The previous HHRA found that the majority of inert ingredients are of minimal risk, and a few are in the category of unknown toxicity.

Dose-Response Assessment

The dose-response assessment identifies the types of adverse health effects an herbicide may potentially cause, and defines the relationship between the dose of an herbicide and the likelihood or magnitude of an adverse effect (response). Dose-response values are used to derive risk estimates. As none of the three herbicides evaluated are designated as potential carcinogens by the USEPA, the dose-response assessment focuses on non-carcinogenic effects (i.e., potential toxic effects other than cancer).

Exposure Assessment

The exposure assessment predicts the magnitude and frequency of potential human exposure to the herbicides under consideration. The BLM takes care to prevent exposures to applied pesticides, both through worker training programs and by posting areas that have just been sprayed with information on when reentry into these areas is appropriate. However, to be conservative, the HHRA has evaluated both routine use and accidental exposure scenarios. Additionally, exposures were evaluated both for applications using the maximum application rate designated by the herbicide label, and for applications using a typical application rate defined by BLM.

Occupational Exposure Scenarios. Routine exposures for occupational receptors include dermal and inhalation exposures that could occur by a worker during an application of the herbicide. For aerial applications, occupational receptors that may come into routine contact with herbicides include pilots and mixer/loaders. For ground applications by backpack, the occupational receptor is assumed to be an applicator/mixer/loader. For the remaining application methods (horseback, and spot and boom/broadcast methods for ATV/UTV and truck mount applications), applicators, mixer/loaders, and applicator/mixer/loaders were evaluated. The exposure dose was calculated using the herbicide application rate and the acres treated per day.

Accidental exposures for occupational receptors could occur via spills or direct spray onto a worker. As a worst-case scenario for an accidental exposure, a direct spill event on an occupational receptor was evaluated. The spill scenario assumes that 0.5 liter (½ quart) of the formulation is spilled on a worker receptor. It is assumed that 80 percent of the spill lands on clothing and 20 percent lands on bare skin. The penetration rate through clothing is assumed to be 30 percent. While some of the herbicide labels require the use of gloves while handling the herbicide, others do not. Therefore, this scenario assumes that gloves are not worn.

Public Use Exposure Scenarios. Public use exposure scenarios involve public receptors using public lands treated with herbicides. Public receptors include: 1) hikers/hunters; 2) berry pickers - child and adult; 3) anglers; 4) swimmers - child and adult; 5) nearby residents - child and adult; and 6) Native Americans - child and adult. Two types of scenarios are addressed:

- Routine-use exposure scenarios in which a public receptor is exposed to herbicide active ingredient(s) that have drifted outside the area of application. It is assumed that the public would heed posted signs and not enter a treatment area during the treatment.

- Accidental scenarios where public receptors may prematurely enter a sprayed area (a reentry scenario), be sprayed directly, or contact water bodies that have accidentally been sprayed directly or into which an herbicide active ingredient has accidentally been spilled.

These public exposure scenarios are thought to be unlikely and represent worst-case conditions. Potential exposure pathways include: 1) dermal contact with spray, 2) dermal contact with foliage, 3) dermal contact with water while swimming, 4) ingestion of drinking water or incidental ingestion of water while swimming, 5) ingestion of berries, and 6) ingestion of fish.

Risk Characterization

The risk characterization estimates of the potential risk to human health from exposure to herbicides. The results of the exposure assessment are combined with the results of the dose-response assessment to derive quantitative estimates of risk. For the noncarcinogenic active ingredients evaluated in this HHRA, risk is described simply by the comparison of the exposure doses to the appropriate dose-response values.

The Aggregate Risk Index (ARI) is a numeric expression of risk that combines potential risks from various exposure pathways, as discussed in more detail in the HHRA (AECOM 2014c). The ARI is compared against a target value of 1. An ARI that is greater than 1 does not exceed the USEPA's level of concern, and indicates that no adverse health effects are expected. An ARI below 1 indicates a potential concern for human health.

Uncertainty in the Risk Assessment Process

The HHRA incorporates various conservative assumptions to compensate for uncertainties in the risk assessment process. Conservative assumptions are made throughout the risk assessment process, since every assumption introduces some degree of uncertainty into the process. Using conservative assumptions exaggerates the risks to err on the side of protecting human health.

Human Health Risks Associated with Herbicides

The types of potential impacts to human health and safety associated with herbicide use in general are discussed in the 2007 PEIS (USDOI BLM 2007a:4-181 to 4-182). This general analysis would continue to apply to herbicide treatments involving aminopyralid, fluroxypyr, and rimsulfuron. It is summarized here, followed by a more detailed analysis specific to the three new active ingredients.

Herbicides can be toxic to humans to varying degrees (any chemical poses a health risk at a high enough dose). Most clinical reports of herbicide effects are of skin and eye irritation. Short-term effects of exposure to herbicides include nausea, dizziness, or reversible abnormalities of the nervous system. In extreme cases of prolonged, repeated, and excessive exposure, longer-term health problems can result, including: organ damage, immune system damage, permanent nervous system damage, production of inheritable mutations, damage to developing offspring, and reduction of reproductive success. The label instructions of each herbicide provide restrictions and precautions on usage that minimize the risk of these effects. As part of registration of herbicides, the USEPA adheres to a uniform, health-based standard to ensure a "reasonable certainty of no harm" to consumers.

The greatest risk for occupational exposure to herbicides occurs when workers must directly handle and/or mix chemicals. Spot and localized applications, which require the most hands-on use of herbicides, carry the greatest risk of exposure. Workers can also be exposed to herbicides from accidental spills, splashing, leaking equipment, contact with spray, or by entering treated areas. Exposure can occur either through skin or through inhalation. Adherence to operational safety guidelines, use of protective clothing, equipment checks, and personal hygiene can prevent incidents from occurring. The herbicide label and corresponding SDSs/MSDSs detail these application requirements in addition to safety guidelines.

Public receptors can be exposed to herbicides by being accidentally sprayed, by entering areas soon after treatment (e.g., eating berries or other foods, and touching vegetation), drinking contaminated water, or accidentally coming into contact with herbicides that have drifted downwind. Members of the general public, both visitors and residents, are less likely to be repeatedly exposed than vegetation management workers. The BLM has SOPs in place to prevent exposure of the public to treated areas. However, there has been one documented account of an accidental spraying (via drift) of a worker engaged in other resource work at the same time as an aerial herbicide application in Nevada. The findings of this incident indicate that both the contractor doing the spraying and the BLM failed to implement SOPs that would have prevented this occurrence. While the BLM has taken steps to ensure that SOPs are followed in the future, the incident shows that even with SOPs in place, accidental exposures to herbicides can occur.

Tables 4-14 and 4-15 are summary tables that show the level of risk each receptor (occupational and public) would face during the application of a given herbicide, for both maximum and typical application rate scenarios. The ARIs are partitioned into no, low, moderate, and high levels of risk for ease of comparison (no risk is identified as an ARI greater than 1, low risk is between 1 and 0.1, moderate risk is between 0.1 and 0.01, and high risk is less than 0.01). These designations are strictly for comparison purposes, and do not imply actual risks to people. Tables 4-16 through 4-24 present more detailed tables of ARIs for each herbicide and receptor under occupational and public exposure scenarios. Based on the HHRA (AECOM 2014c), the three herbicides generally pose very little risk to human health, with rimsulfuron posing some risk to occupational receptors under accidental exposure scenarios.

Aminopyralid

Based on the hazard identification presented in the HHRA, aminopyralid has low acute toxicity via oral, dermal, and inhalation routes of exposure, but may cause severe eye irritation in some forms. At mid- and high-level doses, adverse effects to the stomach, ileum, and cecum have been noted. Developmental and reproduction studies indicate no evidence that fetuses or offspring have increased susceptibility to aminopyralid. Aminopyralid has been classified as "not likely to be carcinogenic to humans," and there is no evidence that it is mutagenic or an endocrine disrupter (USEPA 2009b).

Dermal studies indicate that aminopyralid does not have significant toxicity via the dermal route of exposure, as it is either not absorbed or poorly absorbed through the skin. For this reason, ARIs were derived using oral and inhalation exposures.

As shown in Tables 4-14 and 4-15, there are no risks to occupational or public receptors from exposures resulting from routine use (typical or maximum application rate) or accidental scenarios. Tables 4-16 through 4-18 show the detailed HHRA results for aminopyralid, presenting ARIs by receptor and exposure scenario. For all receptors, ARIs were all well above 1, with the lowest ARI of 94 for a child swimming in a water body following a helicopter spill (Table 4-18). This exposure pathway assumes incidental ingestion of water while swimming. These results indicate that aminopyralid does not present an unacceptable risk to occupational or public receptors, even under worst-case accidental exposure scenarios.

Fluroxypyr

Based on the hazard identification in the HHRA, fluroxypyr has low acute toxicity via oral and dermal routes, and moderate acute toxicity via inhalation. It is not irritating to the skin, but is a mild eye irritant. At high doses, it can target the kidney and result in other adverse health effects. There is no evidence of increased susceptibility following in utero, pre-natal, or post-natal exposure. Endocrine disruption studies have not been conducted. There is no indication that fluroxypyr is carcinogenic or mutagenic (USEPA 2007).

Based on studies involving subchronic dermal exposures of high doses of fluroxypyr, in which no effects were observed, the USEPA has determined that dermal risk assessment is not required for this chemical (USEPA 2007). Therefore, ARIs were derived using oral and inhalation exposures.

As shown in Table 4-14 and 4-15, and shown in more detail in Tables 4-20 and 4-21, there are no risks to occupational or public receptors from exposures resulting from routine use (typical or maximum application rate) or accidental scenarios. For all receptors, ARIs were above 1, with the only ARIs below 500 for accidental exposures involving swimming in a water body following an accidental spill of fluroxypyr. These exposure pathways assume incidental ingestion of water while swimming (Table 4-21). The lowest ARI was for a Native American child swimming in a body of water following a helicopter spill. These results indicate that fluroxypyr does not present an unacceptable risk to occupational or public receptors, even under worst-case accidental exposure scenarios.

TABLE 4-14
Herbicide Risk Categories by Aggregate Risk Index for Occupational Receptors

Receptor	Aminopyralid			Fluroxypyr			Rimsulfuron			
	Typ[1]	Max[1]	Accid[1]	Typ	Max	Accid	Typ	Max	Accid	
									Typ[2]	Max[2]
Plane - pilot	0[3]	0	NC	0	0	NC	0	0	L	M
Plane - mixer/loader	0	0	NC	0	0	NC	0	0	L	M
Helicopter - pilot	0	0	NC	0	0	NC	0	0	L	M
Helicopter - mixer/loader	0	0	NC	0	0	NC	0	0	L	M
Human/backpack - applicator/mixer/loader	0	0	NC	0	0	NC	0	0	L	M
Human/horseback - applicator/mixer/loader	0	0	NC	0	0	NC	0	0	L	M
ATV/UTV - applicator[4]	0	0	NC	0	0	NC	0	0	L	M
ATV/UTV - mixer/loader	0	0	NC	0	0	NC	0	0	L	M
ATV/UTV - applicator/mixer/loader	0	0	NC	0	0	NC	0	0	L	M
Truck - applicator[4]	0	0	NC	0	0	NC	0	0	L	M
Truck - mixer/loader	0	0	NC	0	0	NC	0	0	L	M
Truck - applicator/mixer/loader	0	0	NC	0	0	NC	0	0	L	M

[1] As a main heading: Typ = Typical application rate; Max = Maximum application rate; and Accid = Accidental rate. Typical and maximum application rate categories include short-, intermediate-, and long-term exposures. Accidental scenario category includes accidents with herbicide mixed at both the typical and maximum application rates and with a concentrated herbicide.
[2] As a subheading of the Accidental scenario category: Typ = solution mixed for the typical application rate; and Max = solution mixed for the maximum application rate.
[3] Risk categories: 0 = No risk (majority of ARIs > 1); L = Low risk (majority of ARIs <1 but >0.1); M = Moderate risk (majority of ARIs < 0.1 but > 0.01); and NC = Not calculated. The reported risk category represents the typical/most common risk level for estimated risks from various time periods. See Tables 4-16, 4-19 and 4-22 for the range of risk levels for each scenario. Accidental scenario ARIs were not calculated for aminopyralid or fluroxypyr because accidental scenarios assume a spill directly onto the receptor and aminopyralid and fluroxypyr are not toxic via the dermal route of exposure.
[4] ATV/UTV and Truck categories include spot and boom/broadcast application scenarios.

TABLE 4-15
Herbicide Risk Categories by Aggregate Risk Index for Public Receptors

Receptor	Aminopyralid			Fluroxypyr			Rimsulfuron		
	Typ[1]	Max[1]	Accid[1]	Typ	Max	Accid	Typ	Max	Accid
Hiker/hunter (adult)	NC	NC	NC	NC	NC	NC	0[2]	0	0
Berry picker (child)	NC	NC	NC	NC	NC	NC	0	0	0
Berry picker (adult)	NC	NC	NC	NC	NC	NC	0	0	0
Angler (adult)	NC	NC	NC	NC	NC	NC	0	0	0
Residential (child)	NC	NC	NC	NC	NC	NC	0	0	0
Residential (adult)	NC	NC	NC	NC	NC	NC	0	0	0
Native American (child)	0	0	0	0	0	0	0	0	0
Native American (adult)	0	0	0	0	0	0	0	0	0
Swimmer (child)	0	0	0	0	0	0	NC	NC	NC
Swimmer (adult)	0	0	0	0	0	0	NC	NC	NC

[1] As a main heading: Typ = Typical application rate; Max = Maximum application rate; and Accid = Accidental rate. Typical and maximum application rate categories include short-, intermediate-, and long-term exposures. Accidental scenario category includes accidents with herbicide mixed at both the typical and maximum application rates and with a concentrated herbicide.

[2] Risk categories: 0 = No risk (majority of ARIs > 1); and NC = Not calculated. The reported risk category represents the typical/most common risk level for estimated risks from various time periods. See Tables 4-17, 4-18, 4-20, 4-21, 4-23, and 4-24 for the range of risk levels for each scenario. For aminopyralid and fluroxypyr, no dose-response values are available for dermal exposure or acute dietary exposure due to low toxicity. For rimsulfuron, no dose-response values are available for the incidental oral pathway due to use pattern.

TABLE 4-16
Aminopyralid Aggregate Risk Indices – Occupational Scenarios

Application Type	Application Vehicle	Application Method	Receptor[1]	Typical Application Rate Scenario ARIs			Maximum Application Rate Scenario ARIs			Accidental Scenario ARIs (Short-term Dermal)
				Short-term	Intermediate-term	Long-term	Short-term	Intermediate-term	Long-term	Concentrated Solution[2]
Aerial	Plane	Fixed Wing	Pilot	15,588	15,588	NC	3,684	3,684	NC	NC
Aerial	Plane	Fixed Wing	Mixer/Loader	3,643	3,643	NC	861	861	NC	NC
Aerial	Helicopter	Rotary	Pilot	38,971	38,971	NC	9,211	9,211	NC	NC
Aerial	Helicopter	Rotary	Mixer/Loader	9,107	9,107	NC	2,125	2,152	NC	NC
Ground	Human	Backpack	Applicator/Mixer/Loader	684,755	684,755	NC	121,388	121,388	NC	NC
Ground	Human	Horseback	Applicator/Mixer/Loader	91,301	91,301	NC	36,416	36,416	NC	NC
Ground	ATV/UTV	Spot	Applicator	217,436	217,436	NC	42,828	42,828	NC	NC
Ground	ATV/UTV	Spot	Mixer/Loader	4,856,816	4,856,816	NC	860,981	860,981	NC	NC
Ground	ATV/UTV	Spot	Applicator/Mixer/Loader	202,338	202,338	NC	39,855	39,855	NC	NC
Ground	ATV/UTV	Boom/Broadcast	Applicator	779,412	779,412	NC	153,520	153,520	NC	NC
Ground	ATV/UTV	Boom/Broadcast	Mixer/Loader	1,517,755	1,517,755	NC	322,868	322,868	NC	NC
Ground	ATV/UTV	Boom/Broadcast	Applicator/Mixer/Loader	419,968	419,968	NC	82,721	82,721	NC	NC
Ground	Truck Mount	Spot	Applicator	119,208	119,208	NC	19,273	19,273	NC	NC
Ground	Truck Mount	Spot	Mixer/Loader	2,396,455	2,396,455	NC	322,868	322,868	NC	NC
Ground	Truck Mount	Spot	Applicator/Mixer/Loader	110,931	110,931	NC	17,935	17,935	NC	NC
Ground	Truck Mount	Boom/Broadcast	Applicator	415,686	415,686	NC	122,816	122,816	NC	NC
Ground	Truck Mount	Boom/Broadcast	Mixer/Loader	809,469	809,469	NC	191,329	191,329	NC	NC
Ground	Truck Mount	Boom/Broadcast	Applicator/Mixer/Loader	223,983	223,983	NC	66,177	66,177	NC	NC

[1] Receptor refers to a single worker doing all of the listed tasks.
[2] Based on the assumption that a spill of concentrated liquid occurs to worker skin.
The ARI is based on inhalation exposure because based on the toxicity assessment, dermal exposure is not of concern. Values less than 1 represent a level of concern.
NC = Not calculated. Based on toxicity assessment, dermal exposure is not of concern, and long-term inhalation is not a concern for seasonal treatment.

TABLE 4-17
Aminopyralid Aggregate Risk Indices, Routine Exposure Scenarios for Public Receptors, Short-term Exposure

	Typical Application Rate Scenario ARIs						Maximum Application Rate Scenario ARIs					
AgDrift Scenario	**Aerial**	**Aerial**	**Aerial**	**Aerial**	**Ground**	**Ground**	**Aerial**	**Aerial**	**Aerial**	**Aerial**	**Ground**	**Ground**
Land Type[1]	**Non-forested**	**Non-forested**	**Forested**	**Forested**	**NA**	**NA**	**Non-forested**	**Non-forested**	**Forested**	**Forested**	**NA**	**NA**
Equipment	**Plane**	**Helicopter**	**Plane**	**Helicopter**	**Low Boom**	**High Boom**	**Plane**	**Helicopter**	**Plane**	**Helicopter**	**Low Boom**	**High Boom**
Hiker/Hunter (Adult)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Berry Picker (Child)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Berry Picker (Adult)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Angler (Adult)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Residential (Child)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Residential (Adult)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Native American (Child)	9,894,117	9,904,690	9,812,094	9,950,628	9,951,298	9,946,385	7,013,584	7,021,934	6,957,082	7,055,988	7,056,377	7,052,925
Native American (Adult)	19,227,567	19,248,114	19,068,170	19,337,386	19,338,688	19,329,142	13,629,732	13,645,958	13,519,929	13,712,136	13,712,892	13,706,184
Swimmer (Child)	1,982	1,984	1,966	1,994	1,994	1,993	1,405	1,407	1,394	1,414	1,414	1,413
Swimmer (Adult)	17,752	17,771	17,605	17,853	17,855	17,846	12,584	12,599	12,482	12,660	12,660	12,65

[1] Land type is not applicable to ground scenarios.
ARI values less than 1 represent a level of concern. ARI does not include dietary or dermal exposure due to low toxicity. ARIs are based on swimming exposure.
NA = Not applicable.
NC = Not calculated. No dose-response values are available for dermal exposure or acute dietary exposure due to low toxicity.

TABLE 4-18
Aminopyralid Aggregate Risk Indices for Accidental Exposure Scenarios for Public Receptors Based on Maximum Application Rates

Receptor	Dermal Contact Exposure Pathways					Dietary Exposure Pathways						
	Direct Spray of Receptor	Dermal Contact with Foliage	Swimming[1]			Drinking Water Ingestion			Fish Ingestion			Berry Ingestion
			Spray of Water Body[2]	Helicopter Spill	Truck Spill	Spray of Water Body[2]	Helicopter Spill	Truck Spill	Spray of Water Body[2]	Helicopter Spill	Truck Spill	
Angler	NC	NC	--	--	--	NC	NC	NC	NC	NC	NC	--
Berry Picker (Adult)	NC	NC	--	--	--	NC	NC	NC	--	--	--	NC
Berry Picker (Child)	NC	NC	--	--	--	NC	NC	NC	--	--	--	NC
Hiker/Hunter	NC	NC	--	--	--	NC	NC	NC	--	--	--	--
Native American (Adult)	NC	NC	102,250,368	912,950	3,195,324	NC	NC	NC	NC	NC	NC	NC
Native American (Child)	NC	NC	52,615,970	469,785	1,644,249	NC	NC	NC	NC	NC	NC	NC
Residential (Adult)	NC	NC	--	--	--	--	--	--	--	--	--	--
Residential (Child)	NC	NC	--	--	--	--	--	--	--	--	--	--
Swimmer (Adult)	--	--	94,403	843	2,950	--	--	--	--	--	--	--
Swimmer (Child)	--	--	10,542	94	329	--	--	--	--	--	--	--

[1] Includes incidental ingestion for the swimmer. Incidental ingestion is not included for the Native American pathway because the drinking water pathway is included.
[2] Assumes accidental spray of water body.
-- = Receptor not exposed via this pathway.
ARI values less than 1 represent a level of concern.
NC = Not calculated. No dose-response values available.

TABLE 4-19
Fluroxypyr Aggregate Risk Indices – Occupational Scenarios

Application Type	Application Vehicle	Application Method	Receptor[1]	Typical Application Rate Scenario ARIs			Maximum Application Rate Scenario ARIs			Accidental Scenario ARIs (Short-term Dermal)
				Short-term	Intermediate-term	Long-term	Short-term	Intermediate-term	Long-term	Concentrated Solution[2]
Aerial	Plane	Fixed Wing	Pilot	4,497	4,497	4,497	779	779	779	NC
Aerial	Plane	Fixed Wing	Mixer/Loader	1,051	1,051	1,051	182	182	182	NC
Aerial	Helicopter	Rotary	Pilot	11,242	11,242	11,242	1,949	1,949	1,949	NC
Aerial	Helicopter	Rotary	Mixer/Loader	2,627	2,627	2,627	455	455	455	NC
Ground	Human	Backpack	Applicator/Mixer/Loader	197,525	197,525	197,525	25,678	25,678	25,678	NC
Ground	Human	Horseback	Applicator/Mixer/Loader	26,337	26,337	26,337	7,703	7,703	7,703	NC
Ground	ATV/UTV	Spot	Applicator	62,722	62,722	62,722	9,060	9,060	9,060	NC
Ground	ATV/UTV	Spot	Mixer/Loader	1,401,004	1,401,004	1,401,004	182,131	182,131	182,131	NC
Ground	ATV/UTV	Spot	Applicator/Mixer/Loader	58,367	58,367	58,367	8,431	8,431	8,431	NC
Ground	ATV/UTV	Boom/Broadcast	Applicator	224,830	224,830	224,830	32,475	32,475	32,475	NC
Ground	ATV/UTV	Boom/Broadcast	Mixer/Loader	437,814	437,814	437,814	68,299	68,299	68,299	NC
Ground	ATV/UTV	Boom/Broadcast	Applicator/Mixer/Loader	121,145	121,145	121,145	17,499	17,499	17,499	NC
Ground	Truck Mount	Spot	Applicator	34,387	34,387	34,387	4,077	4,077	4,077	NC
Ground	Truck Mount	Spot	Mixer/Loader	691,285	691,285	691,285	68,299	68,299	68,299	NC
Ground	Truck Mount	Spot	Applicator/Mixer/Loader	31,999	31,999	31,999	3,794	3,794	3,794	NC
Ground	Truck Mount	Boom/Broadcast	Applicator	119,910	119,910	119,910	25,980	25,980	25,980	NC
Ground	Truck Mount	Boom/Broadcast	Mixer/Loader	233,501	233,501	233,501	40,473	40,473	40,473	NC
Ground	Truck Mount	Boom/Broadcast	Applicator/Mixer/Loader	64,611	64,611	64,611	13,999	13,999	13,999	NC

[1] Receptor refers to a single worker doing all of the listed tasks.
[2] Based on the assumption that a spill of concentrated liquid occurs to worker skin.
The ARI is based on inhalation exposure because based on the toxicity assessment, dermal exposure is not of concern. Values less than 1 represent a level of concern.
NC = Not calculated. Based on toxicity assessment, dermal exposure is not of concern, and long-term inhalation is not a concern for seasonal treatment.

TABLE 4-20
Fluroxypyr Aggregate Risk Indices, Routine Exposure Scenarios for Public Receptors, Short-term Exposure

	Typical Application Rate Scenario ARIs						**Maximum Application Rate Scenario ARIs**					
AgDrift Scenario	**Aerial**	**Aerial**	**Aerial**	**Aerial**	**Ground**	**Ground**	**Aerial**	**Aerial**	**Aerial**	**Aerial**	**Ground**	**Ground**
Land Type[1]	**Non-forested**	**Non-forested**	**Forested**	**Forested**	**NA**	**NA**	**Non-forested**	**Non-forested**	**Forested**	**Forested**	**NA**	**NA**
Equipment	**Plane**	**Helicopter**	**Plane**	**Helicopter**	**Low Boom**	**High Boom**	**Plane**	**Helicopter**	**Plane**	**Helicopter**	**Low Boom**	**High Boom**
Hiker/Hunter (Adult)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Berry Picker (Child)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Berry Picker (Adult)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Angler (Adult)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Residential (Child)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Residential (Adult)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Native American (Child)	1,072	975	1,044	1,090	1,086	1,082	556	558	542	567	565	562
Native American (Adult)	2,082	1,895	2,029	2,118	2,110	2,102	1,080	1,084	1,053	1,101	1,097	1,093
Swimmer (Child)	1,724	1,569	1,680	1,754	1,747	1,740	894	898	872	912	909	905
Swimmer (Adult)	4,776	4,347	4,653	4,858	4,840	4,821	2,477	2,487	2,414	2,526	2,517	2,507

[1] Land type is not applicable to ground scenarios.
ARI values less than 1 represent a level of concern. ARI does not include dietary or dermal exposure due to low toxicity. ARIs are based on swimming exposure.
NA = Not applicable.
NC = Not calculated. No dose-response values are available for dermal exposure or acute dietary exposure due to low toxicity.

TABLE 4-21
Fluroxypyr Aggregate Risk Indices for Accidental Exposure Scenarios for Public Receptors Based on Maximum Application Rates

Receptor	Dermal Contact Exposure Pathways					Dietary Exposure Pathways						
	Direct Spray of Receptor	Dermal Contact with Foliage	Swimming[1]			Drinking Water Ingestion			Fish Ingestion			Berry Ingestion
			Spray of Water Body[2]	Helicopter Spill	Truck Spill	Spray of Water Body[2]	Helicopter Spill	Truck Spill	Spray of Water Body[2]	Helicopter Spill	Truck Spill	
Angler	NC	NC	--	--	--	NC	NC	NC	NC	NC	NC	--
Berry Picker (Adult)	NC	NC	--	--	--	NC	NC	NC	--	--	--	NC
Berry Picker (Child)	NC	NC	--	--	--	NC	NC	NC	--	--	--	NC
Hiker/Hunter	NC	NC	--	--	--	NC	NC	NC	--	--	--	--
Native American (Adult)	NC	NC	1,027	9	32	NC	NC	NC	NC	NC	NC	NC
Native American (Child)	NC	NC	528	5	17	NC	NC	NC	NC	NC	NC	NC
Residential (Adult)	NC	NC	--	--	--	--	--	--	--	--	--	--
Residential (Child)	NC	NC	--	--	--	--	--	--	--	--	--	--
Swimmer (Adult)	--	--	2,355	21	74	--	--	--	--	--	--	--
Swimmer (Child)	--	--	850	8	27	--	--	--	--	--	--	--

[1] Includes incidental ingestion for the swimmer. Incidental ingestion is not included for the Native American pathway because the drinking water pathway is included.
[2] Assumes accidental spray of water body.
-- = Receptor not exposed via this pathway.
ARI values less than 1 represent a level of concern.
NC = Not calculated. No dose-response values available.

TABLE 4-22
Rimsulfuron Aggregate Risk Indices – Occupational Scenarios

Application Type	Application Vehicle	Application Method	Receptor[1]	Typical Application Rate Scenario ARIs			Maximum Application Rate Scenario ARIs			Accidental Scenario ARIs (Short-term Dermal)	
				Short-term	Intermediate-term	Long-term	Short-term	Intermediate-term	Long-term	Mixed (Maximum) Solution[2]	Mixed (Typical) Solution[2]
Aerial	Plane	Fixed Wing	Pilot	87	87	NC	29	29	NC	**0.089**	**0.12**
Aerial	Plane	Fixed Wing	Mixer/Loader	4	4	NC	1.5	1.5	NC	**0.089**	**0.12**
Aerial	Helicopter	Rotary	Pilot	217	217	NC	7.2	7.2	NC	**0.089**	**0.12**
Aerial	Helicopter	Rotary	Mixer/Loader	11	11	NC	3.7	3.7	NC	**0.089**	**0.12**
Ground	Human	Backpack	Applicator/Mixer/Loader	94	94	NC	24	24	NC	**0.089**	**0.12**
Ground	Human	Horseback	Applicator/Mixer/Loader	13	13	NC	7	7	NC	**0.089**	**0.12**
Ground	ATV/UTV	Spot	Applicator	283	283	NC	79	79	NC	**0.089**	**0.12**
Ground	ATV/UTV	Spot	Mixer/Loader	5,978	5,978	NC	1,494	1,494	NC	**0.089**	**0.12**
Ground	ATV/UTV	Spot	Applicator/Mixer/Loader	262	262	NC	73	73	NC	**0.089**	**0.12**
Ground	ATV/UTV	Boom/Broadcast	Applicator	6,459	6,459	NC	1,794	1,794	NC	**0.089**	**0.12**
Ground	ATV/UTV	Boom/Broadcast	Mixer/Loader	1,868	1,868	NC	560	560	NC	**0.089**	**0.12**
Ground	ATV/UTV	Boom/Broadcast	Applicator/Mixer/Loader	955	955	NC	265	265	NC	**0.089**	**0.12**
Ground	Truck Mount	Spot	Applicator	155	155	NC	35	35	NC	**0.089**	**0.12**
Ground	Truck Mount	Spot	Mixer/Loader	2,950	2,950	NC	560	560	NC	**0.089**	**0.12**
Ground	Truck Mount	Spot	Applicator/Mixer/Loader	144	144	NC	33	33	NC	**0.089**	**0.12**
Ground	Truck Mount	Boom/Broadcast	Applicator	3,445	3,445	NC	1,435	1,435	NC	**0.089**	**0.12**
Ground	Truck Mount	Boom/Broadcast	Mixer/Loader	906	906	NC	332	332	NC	**0.089**	**0.12**
Ground	Truck Mount	Boom/Broadcast	Applicator/Mixer/Loader	509	509	NC	212	212	NC	**0.089**	**0.12**

[1] Receptor refers to a single worker doing all of the listed tasks.
[2] Based on the assumption that a spill of mixed solution occurs to worker skin.
The ARI is based on inhalation exposure because based on the toxicity assessment, dermal exposure is not of concern. Values less than 1 represent a level of concern. Bolded cells indicate scenarios with ARI values less than 1.
NC = Not calculated. Based on toxicity assessment, dermal exposure is not of concern, and long-term inhalation is not a concern for seasonal treatment.

TABLE 4-23
Rimsulfuron Aggregate Risk Indices, Routine Exposure Scenarios for Public Receptors, Short-term Exposure

	Typical Application Rate Scenario ARIs						Maximum Application Rate Scenario ARIs					
AgDrift Scenario	**Aerial**	**Aerial**	**Aerial**	**Aerial**	**Ground**	**Ground**	**Aerial**	**Aerial**	**Aerial**	**Aerial**	**Ground**	**Ground**
Land Type[1]	**Non-forested**	**Non-forested**	**Forested**	**Forested**	**NA**	**NA**	**Non-forested**	**Non-forested**	**Forested**	**Forested**	**NA**	**NA**
Equipment	**Plane**	**Helicopter**	**Plane**	**Helicopter**	**Low Boom**	**High Boom**	**Plane**	**Helicopter**	**Plane**	**Helicopter**	**Low Boom**	**High Boom**
Hiker/Hunter (Adult)	252	305	59	713	2,139	1,426	178	225	47	535	1,426	328
Berry Picker (Child)	96	116	23	271	813	542	68	86	18	203	542	125
Berry Picker (Adult)	241	291	57	681	2,043	1,362	170	215	45	511	1,362	313
Angler (Adult)	252	305	59	713	2,139	1,426	178	225	47	535	1,426	328
Residential (Child)	79	95	19	222	667	445	56	70	15	167	445	102
Residential (Adult)	183	222	43	518	1,553	1,036	129	163	34	388	1,036	238
Native American (Child)	94	114	22	267	801	534	67	84	18	200	534	123
Native American (Adult)	236	285	56	667	2,000	1,333	167	210	44	500	1,333	307
Swimmer (Child)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Swimmer (Adult)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

[1] Land type is not applicable to ground scenarios.
ARI values less than 1 represent a level of concern. ARI does not include dietary or dermal exposure due to low toxicity. ARIs are based on swimming exposure.
NA = Not applicable.
NC = Not calculated. No dose-response values are available for incidental oral pathway due to use pattern.

TABLE 4-24
Rimsulfuron Aggregate Risk Indices for Accidental Exposure Scenarios for Public Receptors Based on Maximum Application Rates

Receptor	Dermal Contact Exposure Pathways					Dietary Exposure Pathways						
	Direct Spray of Receptor	Dermal Contact with Foliage	Swimming[1]			Drinking Water Ingestion			Fish Ingestion			Berry Ingestion
			Spray of Water Body[2]	Helicopter Spill	Truck Spill	Spray of Water Body[2]	Helicopter Spill	Truck Spill	Spray of Water Body[2]	Helicopter Spill	Truck Spill	
Angler	12	104	--	--	--	NC	NC	NC	NC	NC	NC	--
Berry Picker (Adult)	7	61	--	--	--	NC	NC	NC	--	--	--	NC
Berry Picker (Child)	3	35	--	--	--	NC	NC	NC	--	--	--	NC
Hiker/Hunter	7	104	--	--	--	NC	NC	NC	--	--	--	--
Native American (Adult)	7	51	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Native American (Child)	3	29	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Residential (Adult)	7	15	--	--	--	--	--	--	--	--	--	--
Residential (Child)	3	9	--	--	--	--	--	--	--	--	--	--
Swimmer (Adult)	--	--	NC	NC	NC	--	--	--	--	--	--	--
Swimmer (Child)	--	--	NC	NC	NC	--	--	--	--	--	--	--

[1] Includes incidental ingestion for the swimmer. Incidental ingestion is not included for the Native American pathway because the drinking water pathway is included.
[2] Assumes accidental spray of water body
-- = Receptor not exposed via this pathway.
ARI values less than 1 represent a level of concern.
NC = Not calculated. No dose-response values available.

Rimsulfuron

Based on the hazard identification presented in the HHRA, rimsulfuron has low acute toxicity orally, by dermal exposure, and by inhalation, but is a moderate eye irritant. It is not a dermal sensitizer. Based on subchronic and chronic toxicity studies, long-term exposures to rimsulfuron can cause a variety of adverse health effects targeting multiple organs. No developmental toxicity has been observed at high doses, and there is no evidence that rimsulfuron is an endocrine disruptor. Rimsulfuron is classified as "Not Likely a Human Carcinogen" (USEPA 2011).

As shown in Table 4-14, there is no risk to occupational receptors under routine exposure scenarios, but low to moderate risk under accidental exposure scenarios. These scenarios assume that a mixed solution of rimsulfuron is spilled directly onto an occupational receptor, and that use of proper personal protective equipment (PPE) would not prevent dermal exposure. Therefore, this risk represents an unlikely scenario that could be avoided through proper handling of the herbicide, following all SOPs and label instructions, and use of appropriate personal protective equipment. Table 4-22 shows the detailed HHRA results for occupational exposure scenarios.

As summarized in Table 4-15, and shown in more detail in Tables 4-23 and 4-24, there is no risk to public receptors under routine or accidental exposure pathways. All of the calculated ARIs are above 1. The lowest ARIs were for accidental direct spray scenarios involving children. These results indicate that rimsulfuron does not present an unacceptable risk to public receptors, even under worst-case accidental exposure scenarios.

Impacts by Alternative

The following is a qualitative discussion of how risk from herbicide exposure would vary under each herbicide treatment alternative.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under this alternative, the BLM would continue to implement herbicide treatments using the 18 herbicides previously approved in the 2007 PEIS. The total area treated with herbicides would be the similar to the action alternatives, with differences in risk pertaining to the relative amount of different herbicides used, and their associated level of risk. Risks to humans from the use of the previously approved chemicals vary, ranging from no risk to high risk to occupational and public receptors, depending on the exposure scenario. Herbicides with the greatest amount of associated risk include 2,4-D, bromacil, diquat, fluridone, hexazinone, tebuthiuron, and triclopyr (see the 2007 PEIS for more information [USDOI BLM 2007a:4-182 to 4-193]). Of these, the active ingredients with the greatest projected usage under this alternative include triclopyr, tebuthiuron, and 2,4-D. Human health risks from these chemicals would continue to be minimized by following all label instructions, and SOPs to prevent accidental exposures and protect human health. Additionally, the mitigation measures specified in the ROD for the 2007 PEIS (USDOI BLM 2007b:Table 2), such as using the typical application rate of these chemicals, where feasible, would help to further minimize risks to occupational and public receptors.

Under this alternative, ongoing treatment programs with the currently approved herbicides would continue to provide benefits to human health by reducing the occurrence of noxious weeds and other invasive vegetation. Additionally, ongoing treatment of species that increase the risk of wildfire, such as cheatgrass, would reduce the risk of wildfire and the associated public health and safety risks.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under the Preferred Alternative, general risks associated with herbicide treatments would be much the same as under the No Action Alternative, as roughly the same acreage would be treated with herbicides. The ability to use aminopyralid, fluroxypyr, and rimsulfuron for vegetation treatments could result in a slight change in risk in certain treatment areas, as the relative amount of herbicides would change. All three of the new herbicides have no to very low risk to human health (with an unacceptable risk only predicted for one accidental exposure scenario involving rimsulfuron). However, the three herbicides with the most substantial predicted decrease in usage under this alternative—imazapic, glyphosate, and picloram—also have no to low human health risks. Use of the herbicides with higher risk would likely remain at or near current levels. Therefore, there would be little difference in risks to human health and safety between the Preferred Alternative and the No Action Alternative.

Introduction of the three new herbicides may allow the BLM to be more efficient at controlling certain target noxious weeds and other invasive vegetation, which would have an associated health benefit. Use of rimsulfuron may allow for better control of cheatgrass, and an associated reduction in wildfire risk. These beneficial effects are expected to be minor.

Alternative C – No Aerial Application of New Herbicides

Under Alternative C, human health risks associated with herbicide treatments would be similar to those under the Preferred Alternative and the No Action Alternative. The new herbicides would not be applied aerially, eliminating certain exposure pathways for occupational and public receptors. According to the HHRA, ARIs for aerial application scenarios are generally lower than those for ground-based methods, indicating greater overall risk. However, there are no differences in risk categories between aerial and ground application, as shown in Tables 4-14 and 4-15. Additionally, restriction of aerial applications of the new chemicals would not reduce aerial spraying of herbicides, as different active ingredients would be used where aerial spraying is needed. For instance, to control cheatgrass, the currently approved imazapic would be used in aerial applications where rimsulfuron would have otherwise been used. Furthermore, the maximum total area treated using herbicides would not differ from that under the other alternatives.

The relative use of the different chemicals would be slightly different than under the No Action and Preferred Alternatives, with use of the three new herbicides being lower than under the Preferred Alternative, and use of glyphosate, imazapic, and picloram falling between the levels estimated for the No Action and Preferred Alternatives. The relative amounts of the other herbicides used would be roughly the same as under the other alternatives. As the active ingredients with usage levels that would change are all generally no to low risk herbicides, overall risk from herbicide use would be similar to that under the other alternatives.

Being unable to aerially apply the new herbicides could have an impact on the effectiveness of herbicide treatments to some degree, although the currently approved herbicides could still be used to control the target species via aerial methods. While less benefit to human health from control of noxious weeds and wildfire fuels is possible, the differences are expected to be minor, relative to the Preferred Alternative.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under this alternative rimsulfuron would not be used, and as a result use of glyphosate and imazapic would be higher than under the other action alternatives, similar to the No Action Alternative. However, since the differences in relative projected use involve all no- to low-risk active ingredients, overall risks to human health associated with herbicide treatments would be similar to those under the other alternatives. Since the total area treated using herbicides is expected to be the same under all the alternatives, there would be little to no difference in human health risk associated with potential exposure to herbicides.

Under this alternative, the BLM would not be able to use rimsulfuron to control cheatgrass and other winter annual grasses. As there is evidence that rimsulfuron may be more effective than imazapic and glyphosate in certain situations, the human health benefits associated with cheatgrass removal could be slightly less under this alternative than under the Preferred Alternative. It is expected that this difference would be minor.

Mitigation

As discussed previously, herbicide treatments involving the new chemicals would continue to follow all of the applicable SOPs for herbicide treatments listed in the 2007 PEIS and earlier in this resource section. The ROD (USDOI BLM 2007b:Table 2) lists additional mitigation measures for herbicide applications that would also continue to be followed, although these measures are specific to currently approved herbicides and would not apply to the new herbicides, unless used in a mixture with one of the other active ingredients.

Given the safety of aminopyralid, fluroxypyr, and rimsulfuron to humans, no additional mitigation measures are recommended for herbicide treatments with these active ingredients.

Cumulative Effects Analysis

Under NEPA and its implementing guidelines, an assessment of the proposed project and other projects that have occurred in the past, are occurring in the present, or are likely to occur in the future, which together may have cumulative impacts that go beyond the impacts of the proposed project itself, is required.

According to the Act (40 CFR §1508.7 and 1508.25[a][2]):

"Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. In addition, to determine the scope of Environmental Impact Statements, agencies shall consider cumulative actions, which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement."

The purpose of this cumulative effects analysis is to determine if the effects of BLM vegetation treatments with aminopyralid, fluroxypyr, and rimsulfuron have the potential to interact or accumulate over time and space, either through repetition or when combined with other effects, and under what circumstances and to what degree they might accumulate.

The 2007 PEIS provides a thorough cumulative effects analysis for the BLM's herbicide treatment program (USDOI BLM 2007a:4-197 to 4-246). Since the three new herbicides would be added to an existing program, with no change in goals or acres or areas treated, much of the 2007 analysis is inclusive of their use and does not warrant repetition here. The analysis presented here provides a general summary of the 2007 analysis, with updated information provided where available. Additionally, the analysis will include a discussion of the cumulative effects associated with adding the three new herbicide active ingredients to the BLM's list of approved active ingredients.

Structure of the Cumulative Effects Analysis

The structure of the cumulative effects analysis is described in the 2007 PEIS (USDOI BLM 2007a:4-197 to 4-201).

Class of Actions to be Analyzed – Large, regional scale trends and issues that require integrated management across broad landscapes, and regional-scale trends and changes in the social and economic needs of people.

Appropriate Temporal Domain – The analysis period is from 1930 through 2057. This is the date that was identified in the 2007 PEIS. As the three new active ingredients are being incorporated into the treatment programs identified in the 2007 PEIS, the analysis period remains the same.

Appropriate Spatial Domain – The analysis area includes public lands in 17 western states, as well as adjacent and nearby non-federal lands, depending on the resource area.

Set of Receptors to be Assessed – The physical, biological, and human systems discussed in Chapter 3 (Affected Environment).

Magnitude of Effects and Whether They are Accumulating – Consider additive, countervailing, and synergistic effects, using quantitative (where possible) and qualitative analysis.

Resource Protection Measures and Other Information Considered in the Cumulative Effects Analysis

The resource protection measures considered in the 2007 cumulative effects analysis (USDOI BLM 2007a:4-201 to 4-202) are considered in the current analysis. They include SOPs, monitoring measures, and mitigation provided in the 2007 PEIS and PER (USDOI BLM 2007a:Chapter 2; USDOI BLM 2007c:Chapter 2). Additionally, they include all new mitigation measures that have been developed by the BLM for use of the three new herbicides, which can be found in Chapter 2 of this document.

Additionally, federal, state, local, and tribal resource management and monitoring programs that pertain to protection of environmental resources and restoration of impaired resources are also considered in the cumulative effects analysis. Regulatory programs exist for air quality, water quality, wetlands, essential fish habitat, threatened and endangered species, and environmental justice.

Other pertinent information considered in the cumulative effects analysis includes the following:

- Mitigation and SOPs identified in 2007 PEIS would be more stringent than those required by the USEPA.
- The BLM would comply with existing and future regulations, including the FLPMA.

- A site-specific NEPA analysis would be conducted prior to implementing vegetation treatments on public lands.

Analysis of Cumulative Effects by Resources

Air Quality

Past Effects and Their Accumulation

Past effects to air quality, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-202 to 203). They include emissions associated with wildfire and prescribed fire, vehicle exhaust, commercial and industrial land uses, and residential heating, among other sources.

Since the 2007 PEIS was released in 2007, the USDOI has begun to track GHG emissions, and in 2012 developed goals for reducing GHG emissions (USDOI BLM 2014f). Since 2008, the USDOI has reduced direct (vehicle) and certain indirect (e.g., purchased electricity) GHG emissions by 11.6 percent, and reduced other indirect GHG emissions (e.g., airline business travel) by 7.5 percent.

Nationwide, air quality has continued to improve since over the last few decades. Between 1990 and 2000, air pollution decreased for PM_{10} (38 percent), lead (83 percent), NO_2 (45 percent), CO (73 percent), and SO_2 (75 percent). $PM_{2.5}$ concentrations decreased between 2001 and 2010, and ozone concentrations decreased between 2002 and 2010. Many toxic air pollutants also declined. Pollutants of primary concern continue to be PM and ozone. Greenhouse gas emissions continue to increase in the U.S.; they have increased by 7 percent since 1990 (USEPA 2012f).

Based on data from the National Interagency Fire Center, the annual number of wildfires between 1987 and 2012 has remained relatively steady, but the acreage burned and average size of fires has increased (EcoWest 2014). Therefore, wildfires continue to contribute to air pollution at increasing levels, although there is quite a bit of variability from year to year.

Future Effects and Their Accumulation

Future effects to air quality, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-202 to 203). The discussion focuses on fire-related impacts to air quality, which are a main source of concern in the area affected by the BLM's vegetation treatments. Sources of air quality pollutants discussed in the preceding section, such as wildfire and vehicle emissions, will continue to contribute to cumulative air quality emissions. Contributions of GHG emissions will also be cumulative, and will potentially have an impact at a global scale by contributing to climate change. It is expected that in the future, air quality overall will continue to improve, although emissions associated with wildfire may continue to increase. Better vehicle emission standards, other regulations, and efforts by the USEPA, local air agencies, and other agencies to reduce air quality emissions will all contribute to this improvement in air quality.

Based on current trends, it is expected that GHG emissions will continue to increase in the future, and will continue to contribute to climate change. Increased drought conditions in the western U.S. could, in turn, contribute to an increase in wildfire, which would contribute additional air quality pollutants to the atmosphere.

Efforts by the BLM, Forest Service, and other agencies to reduce the risk of wildfire on lands that they manage will help offset some of the impacts to air quality associated with wildfires. These programs are likely to be ongoing during the duration of the period of analysis covered by this PEIS.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be the similar under all of the alternatives, the contribution to air quality in terms of pollutants generated during treatments would also be the similar under all the alternatives. Air quality emissions are directly correlated with treatment acreage, as they are correlated to number of vehicle miles driven. The geographic location of air quality impacts would also be the similar under all the alternatives. Air quality emissions associated with treatment programs would be cumulative to other releases of criteria pollutants and GHGs within the geographic areas affected by treatments.

Long-term benefits to air quality from a reduction in wildfire risk would also be similar under all the alternatives.

Soil Resources

Past Effects and Their Accumulation

Past effects to soil resources and their accumulation are discussed in the 2007 PEIS (USDOI BLM 2007a:4-205). They are predominantly associated with natural resource extraction, renewable energy development, grazing, road construction, timber harvesting, OHV and other recreation use, agriculture, development, wildland fire, and natural disturbances.

Future Effects and Their Accumulation

Future effects to soil resources and their accumulation are discussed in the 2007 PEIS (USDOI BLM 2007a:4-205 to 4-206). The factors contributing to past effects to soil, as described in the previous paragraph, are ongoing in the West, and will continue to impact soil resources. Additionally, vegetation treatments by the BLM will contribute to short-term loss of soil functions, process, and productivity on nearly all treated land. Adverse effects to soil will be offset by watershed-level restoration treatments designed and implemented by the BLM and other federal agencies with large landholdings in the West. Numerous policies, programs, and initiatives have been proposed to restore soil productivity and improve the health of ecosystems by the BLM and other federal, state, and local land management entities. In addition, conservation programs and BMPs to reduce soil loss in agricultural areas have been developed and implemented during the past several decades. All efforts to reduce the spread of invasive vegetation, and to reduce the risk of wildfire, are expected to help maintain soil productivity and function.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be similar under all of the alternatives, the contribution of the various alternatives to soil impacts in terms of losses in soil function and productivity would also be similar. Countervailing effects associated with long-term improvement in soil function and productivity would also be similar under all the alternatives.

Under the No Action Alternative, the number of herbicides used by the BLM with the potential to impact soil resources would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. It is expected that impacts associated with all of the herbicide active ingredients would be short-lived, as herbicides and their breakdown products would degrade over time. However, the ways in which these chemicals might interact and the potential for synergistic effects from use of multiple active ingredients are largely unknown. The action alternatives would result in a cumulative increase in the number of herbicide active ingredients with the potential to impact soil and soil organisms.

Water Resources and Quality

Past Effects and Their Accumulation

Past effects to water resources and their accumulation are discussed in the 2007 PEIS (USDOI BLM 2007a:4-207 to 4-208). They are predominantly associated with mining activities, exploration and development of oil resources, agriculture (including use of pesticides), industry, and other human activities.

Based on the most recent (2004) National Water Quality Inventory Report to Congress (USEPA 2009a), an assessment of streams in the western U.S. determined that the most prevalent stressors were nitrogen, phosphorus, riparian disturbance, and streambed sediments.

Based on the most recent Alaska Water Quality Assessment Report (USEPA 2010b), the primary causes of impairment are turbidity, fecal coliform, and sedimentation/siltation, with resource extraction and urban runoff/stormwater as the primary sources of impairment.

Groundwater and surface water quality in the West have been impacted by pollutants associated with agriculture and other activities. Additionally, water quantity has been impacted in many areas of the West, largely as a result of ongoing population growth and irrigation. As documented by the NAWQA, pesticides or their degradates are prevalent in streams, and have been detected in more than half of the shallow wells sampled in agricultural and urban areas, and in 33 percent of the deeper wells that tap major aquifers (USGS 2006). About 1 percent of public-supply wells sampled by NAWQA had a pesticide concentration greater than a human health benchmark.

According to a recent study documenting trends in pesticide concentrations in U.S. streams and rivers, the proportion of mixed land use streams with pesticides exceeding aquatic life benchmarks has generally stayed the same over the last 20 years, with concentrations of individual pesticides varying in response to shifts in use patterns (Stone et al. 2014).

Future Effects and Their Accumulation

Future effects to water resources and their accumulation are discussed in the 2007 PEIS (USDOI BLM 2007a:4-208).

While it is difficult to predict the extent and magnitude of future effects to water resources and quality, it is assumed that activities that contribute to water quality pollution and depletion will continue in the western states. At the same time, efforts to improve water quality are ongoing, including goals by the BLM for percent of water bodies meeting State Water Quality Standards. Target goals are raised every year. The BLM and other land management agencies also continue programs to restore degraded wetland/riparian areas, which includes vegetation management programs. Programs that will be implemented to meet restoration goals are the same as those that were discussed in the 2007 PEIS.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be similar under all of the alternatives, the impacts to water resources in terms of degradation of water quality associated with treatments also would be similar under all the alternatives. Countervailing effects associated with long-term improvement in function of wetlands, riparian areas, streams, and other water bodies would also be similar under all the alternatives.

Under the No Action Alternative, the number of herbicides used by the BLM with the potential to impact water resources would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. It is expected that impacts associated with all of the herbicide active ingredients would be short-lived, as herbicides and their breakdown products would degrade over time. However, the ways in which these chemicals might interact and the potential for synergistic effects from use of multiple active ingredients are largely unknown. Additionally, it is unknown the degree to which these degradates might persist in groundwater. The action alternatives would result in a cumulative increase in the number of herbicide active ingredients with the potential to impact water resources and result in groundwater contamination.

Wetland and Riparian Areas

Past Effects and Their Accumulation

Past effects to wetland and riparian areas and their accumulation are discussed in the 2007 PEIS (USDOI BLM 2007a:4-209 to 4-210). They are predominantly associated with natural resource extraction, recreation, dams and diversions, road construction, agriculture, urbanization, and fire exclusion. Invasive plants and catastrophic wildfires degrade wetland and riparian function. Wetland losses in the lower 48 states have continued to decline, although the rate has been slowed by reestablishment of wetlands. Estimated net wetland loss for the lower 48 states from 2004 to 2009 was 62,300 acres (USFWS 2011). However, most of these wetlands were in the southeastern United States.

On BLM lands in the lower 48 states, 44 percent of wetlands surveyed are not functioning properly or are functioning at risk (USDOI BLM 2012a). This percentage continues to increase, despite efforts by the BLM to improve proper functioning condition. Only 16 percent of riparian areas in the lower 48 states are non-functional or functioning at risk, and the trend on BLM lands is one of improvement in riparian condition. In Alaska, impacts have been less, and nearly all wetlands and riparian areas are in properly functioning condition.

Future Effects and Their Accumulation

Future effects to wetlands and riparian areas and their accumulation are discussed in the 2007 PEIS (USDOI BLM 2007a:4-210).

Factors that contribute to degradation of wetlands and riparian areas, as described in the previous section, continue to varying degrees in the West. Climate change may also contribute to impacts, particularly as a result of increased temperatures and extended drought periods. Ongoing efforts to protect wetlands and riparian areas have reduced the level of impact of natural and human factors that degrade these habitats. Additionally, vegetation treatment programs by the BLM and Forest Service, along with restoration efforts by other agencies, private landowners, and other entities, continue to improve the condition of degraded wetland and riparian habitats. While it is difficult to predict the extent and magnitude of future effects to water resources and quality, it is assumed that activities that contribute to water quality pollution and depletion will continue in the western states. At the same time, efforts to improve water quality are ongoing, including goals by the BLM for percent of water bodies meeting State Water Quality

Standards, which increase each year. The BLM and other land management agencies also continue programs to restore degraded wetland/riparian areas, which includes vegetation treatment programs. Future treatment programs that will be implemented to meet restoration goals are the same as those that were discussed in the 2007 PEIS.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be similar under all of the alternatives, potential impacts to wetlands and riparian areas associated with herbicide treatments would also be similar under all the alternatives. Some herbicides would be released into wetland and riparian areas, and removal of vegetation could have short-term impacts to functions. Countervailing effects associated with long-term improvement in function of wetlands, riparian areas, streams, and other water bodies would also be similar under all the alternatives.

Under the No Action Alternative, the number of herbicides used by the BLM with the potential to impact water resources would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. It is expected that impacts associated with all of the herbicide active ingredients would be short-lived, as herbicides and their breakdown products would degrade over time. However, the ways in which these chemicals might interact and the potential for synergistic effects from use of multiple active ingredients are largely unknown. Additionally, it is unknown the degree to which these degradates might persist in groundwater or wetland or riparian soils. The action alternatives would result in a cumulative increase in the number of herbicide active ingredients with the potential to impact wetland and riparian habitats and the species found in them.

Vegetation

Past Effects and Their Accumulation

Past effects to vegetation (including native plant communities and special status plant species), and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-211 to 4-212). They are predominantly associated with exclusion of fire and alteration of natural disturbance regimes, timber harvest, reseeding and planting programs, and grazing. Human activities have altered native plant communities, and have led to the introduction and spread of invasive species.

Future Effects and Their Accumulation

Future effects to vegetation, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-212 to 4-213). Many of the same human activities that have altered native plant communities in the past will continue to do so in the future. Populations of invasive species will continue to spread, and altered disturbance regimes will continue to cause large wildfires that further alter vegetation in the western U.S. Treatments by the BLM, Forest Service, and other entities to remove hazardous fuels and control invasive species will help offset these adverse effects, although multiple treatments followed by restoration would be necessary to recover native communities and restore disturbance regimes in targeted areas.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be similar under all of the alternatives, the contribution to vegetation impacts in terms of departure from native conditions and disturbance regimes would also be similar under all the alternatives. Countervailing effects associated with long-term improvement in plant communities and reduction in fire risk would also be similar under all the alternatives.

Under the No Action Alternative, the number of herbicides used by the BLM with the potential to impact vegetation would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. Under all alternatives, herbicides would be available that would allow the BLM to meet their treatment goals to restore native communities. The action alternatives would allow the BLM additional options for treating invasive species that could improve the effectiveness of treatment programs in certain circumstances. In all cases, herbicide treatments could be used in concert with other vegetation treatment methods. Additionally, aminopyralid and fluroxypyr would be tank mixed with other active ingredients, which could result in additive or even synergistic effects to non-target plants.

Fish and Other Aquatic Organisms

Past Effects and Their Accumulation

Past effects to fish and other aquatic resources (including special status aquatic species), and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-214 to 4-215). They are predominantly associated with natural resource extraction; recreation;

fire exclusion; construction of roads, dams, and hydropower facilities; agriculture; and urbanization. In Alaska, oil and gas development, and subsistence and recreational fishing, have been the primary factors affecting fish and aquatic resources.

The spread of invasive plant species and increase in catastrophic wildfires in the western U.S. have also been a factor in the degradation of water bodies that provide habitat for fish and other aquatic organisms.

The BLM, other federal and state agencies, private landowners, and businesses have implemented pest and invasive plant control efforts that have resulted in the application of thousands of tons of herbicides and other pesticides to the environment. Some of these pesticides break down relatively quickly in the environment or are not harmful to aquatic organisms at typical application rates. However, some are harmful to aquatic organisms and may be persistent in the environment.

Future Effects and Their Accumulation

Future effects to fish and other aquatic resources, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-215). As discussed under the cumulative effects discussions for water resources, wetlands, and riparian areas, it is assumed that activities that contribute to the degradation and loss of these habitats will continue to occur in the western states, although they will be offset to some degree by protective regulations and restoration efforts, driven by goals to improve water quality and regain the proper functioning condition of riparian areas. Additionally, efforts to remove dams and other blockages to fish passage will continue to benefit fish populations by expanding their ranges.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be similar under all of the alternatives, the impacts to habitats that support fish and aquatic resources would also be similar under all the alternatives. Countervailing effects associated with long-term improvement in function of aquatic habitats would also be similar under all the alternatives.

Under the No Action Alternative, the number of herbicides used by the BLM with the potential to impact water resources would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. The potential toxicological effects to fish and aquatic invertebrates associated with the active ingredients vary. By allowing the BLM the option of using additional active ingredients, the action alternatives would result in a cumulative increase in the number of active ingredients released to the environment that could enter aquatic habitats. As the three herbicides have a very low risk to aquatic species, a cumulative effect of adding these active ingredients could be a reduction in overall risk to aquatic species associated with herbicide use.

It is expected that impacts associated with all of the herbicide active ingredients would be short-lived, as herbicides and their breakdown products would degrade over time. However, the ways in which these chemicals might interact and the potential for synergistic effects from use of multiple active ingredients are largely unknown. Additionally, it is unknown the degree to which these degradates might persist in aquatic habitats.

Herbicides and other pesticides may interact with a wide range of pollutants and various other chemical and non-chemical factors, in ways that are poorly understood, to result in adverse effects to aquatic populations, species, communities, and ecosystems (Scholz et al. 2012).

Wildlife Resources

Past Effects and Their Accumulation

Past effects to wildlife and their accumulation are discussed in the 2007 PEIS (USDOI BLM 2007a:4-216 to 4-220). The discussion considers habitat loss, modification, and fragmentation, and wildlife health. Habitat loss has occurred as a result of conversion to agriculture, pastureland, and residential, commercial industrial, and other development. On lands that have not been converted to other uses, including most of the lands managed by the BLM, habitat modification has reduced their value to wildlife. The primary factors contributing to habitat modification in the West include grazing by domestic livestock and wild horses and burros, timber management, fire suppression, and invasion by invasive plants and other unwanted vegetation. Mature forests, sagebrush habitats, and grasslands have been most affected. Causes of wildlife death, injury, sickness, and disturbance include hunting, collisions with vehicles and structures, wildland and prescribed fires, recreation, and pesticide use.

Future Effects and Their Accumulation

Future effects to wildlife, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-212 to 4-213). Many of the causes of impacts to wildlife discussed in the preceding section will continue to have effects on wildlife. Loss, modification, and fragmentation of habitat will likely continue, increasing the likelihood of local extirpations of wildlife populations and loss of species diversity. Actions to protect sensitive species and their habitats, restore native plant communities and disturbance regimes, control the spread of invasive species, and reduce the risk of catastrophic wildfire are all expected to help offset some of the adverse impacts to wildlife and wildlife habitat.

Use of herbicides and other pesticides will continue and likely increase, and wildlife will continue to be at risk for exposure to these chemicals. Identifying and restricting use of active ingredients with the greatest toxicological risks to wildlife in favor of active ingredients with lower risks would help reduce cumulative effects associated with exposure to pesticides.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be similar under all of the alternatives, the impacts to wildlife habitat would also be similar under all the alternatives. Countervailing long-term effects associated with restoration of native plant communities and disturbance regimes would also be similar under all the alternatives.

Under the No Action Alternative, the number of herbicides used by the BLM with the potential to impact wildlife would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. The potential toxicological effects to wildlife associated with the active ingredients vary. By allowing the BLM the flexibility to use additional herbicides, the action alternatives would result in the release of a larger number of active ingredients. As the three herbicides have a very low risk to wildlife, a cumulative effect of adding these active ingredients could be a reduction in overall risk to wildlife associated with herbicide use, as use of herbicides with a greater risk to wildlife would potentially be less.

It is expected that impacts associated with all of the herbicide active ingredients would be short-lived, as herbicides and their breakdown products would degrade over time. The ways in which aminopyralid, fluroxypyr, and rimsulfuron might interact with other active ingredients and the potential for synergistic effects are largely unknown. Additionally, the toxicity of breakdown products to wildlife is largely unknown.

Livestock

Past Effects and Their Accumulation

Past effects to livestock, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-222). They are predominantly associated with a decrease in the ability of public lands to support livestock grazing, which has occurred as a result of changes in fire regimes and the spread of noxious weeds. Past livestock grazing has contributed to these adverse effects, as have mineral extraction, recreation, and other activities.

Future Effects and Their Accumulation

Future effects to livestock, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-222 to 4-223). Many of the factors discussed in the preceding paragraph are ongoing and will continue to impact the quality of rangelands utilized by livestock. However, these effects will be minimized or offset by ongoing management programs designed to restore ecosystem processes and maintain livestock populations in balance with the health of rangelands. Treatments that control noxious rangeland weeds and reduce the risk of fire will also help to improve rangeland quality.

Contribution of Treatment Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be the same under all of the alternatives, there would be no difference in the amount of rangeland targeted by herbicide treatments under any of the alternatives. Use of herbicides in rangelands could have some short-term adverse effects by removing large areas of vegetation and non-target species used by livestock as forage. However, over the long term it would have countervailing effects of improving the quality of rangeland forage and controlling noxious weeds that are unpalatable or toxic to livestock.

Under the No Action Alternative, the number of herbicides used by the BLM with the potential to impact livestock would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. The potential toxicological effects to livestock associated with herbicide active ingredients vary. However, the three new herbicides are not associated with toxicological risks to livestock, and their use may result in a reduction in the use of active ingredients with greater toxicological risks. Therefore, a cumulative effect of adding these active ingredients could be a reduction in overall risk to livestock associated with herbicide use.

Wild Horses and Burros

Past Effects and Their Accumulation

Past effects to wild horses and burros, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-223 to 4-225). They include a large reduction in the wild horse and burro populations in the 1930s and 1940s as a result of capture and removal, which was halted with the passage of the Wild Free-Roaming Horses and Burros Act of 1971. Since then, the BLM has attempted to maintain populations at levels that can be supported by the available resources, but populations continue to be well above that level. Activities that reduce the quantity or value of available resources have had an adverse effect on wild horses and burros. These include development, grazing, and building of fences and other structures that impede herd movements.

The maximum AML is currently 26,684, which is lower than it was when the 2007 PEIS was completed. However, the total number of wild horses and burros on public lands has increased since then to 49,209, which is over 22,500 animals more than public rangeland can sustain (USDOI BLM 2014a).

Future Effects and Their Accumulation

Future effects to wild horses and burros, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-225). The BLM will continue management efforts to keep wild horse and burro populations at AMLs in balance with the condition of rangelands, which will require continued removal and adoption of animals, as well as measures to control reproduction. Additionally, the factors discussed in the preceding section will continue to impact the quality of rangelands and impede movement by wild horses and burros. Treatments that control noxious rangeland weeds and reduce the risk of fire will also help to improve rangeland quality and its ability to support wild horse and burro populations.

Contribution of Alternatives to Cumulative Effects

The acreage of rangelands treated with herbicides would be similar under all of the alternatives. Use of herbicides in rangelands could have some short-term adverse effects by removing large areas of vegetation and non-target species used by wild horses and burros as forage. However, over the long term it would have countervailing effects of improving the quality of rangeland forage and controlling noxious weeds that are unpalatable or toxic to wild horses and burros.

Under the No Action Alternative, the number of herbicides used by the BLM with the potential to impact wild horses and burros would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. The potential toxicological effects to wild horses and burros associated with herbicide active ingredients vary. However, the three new herbicides are not associated with toxicological risks to large mammals, and their use may result in a reduced need for active ingredients with greater toxicological risks. Therefore, a cumulative effect of adding the three new active ingredients could be a reduction in overall risk to wild horses and burros associated with herbicide use.

Paleontological and Cultural Resources

Past Effects and Their Accumulation

Past effects to paleontological and cultural resources, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-223 to 4-225). Past exploration and development in the western U.S. has led to legal and illegal collection of paleontological resources and inadvertent damage. Many cultural resources have been lost or damaged by exposure to the elements or by collection or destruction of cultural sites. These losses are permanent, but have been slowed by legislation designed to protect these resources from damage and removal.

Future Effects and Their Accumulation

Future effects to paleontological and cultural resources, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-226 to 4-228). While the widespread loss and damage of paleontological and cultural resources has been slowed, ground-disturbing activities with the potential to disturb undiscovered resources continue to occur in the western U.S. These activities include resource extraction, livestock grazing, and motorized recreation, among others. Over time, additional buried resources may be exposed naturally through erosion, increasing their susceptibility to damage or collection. Additionally, wildfires and invasive species have altered native plant communities, and continue to displace native plants and animals that provide traditional lifeway values to Native peoples.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be the same under all of the alternatives, there would be no difference in the geographic extent of public lands targeted by herbicide treatments under any of the alternatives. Therefore, risks for impacts to paleontological and cultural resources would also be the same. Countervailing effects associated with controlling invasive species and reducing the risk of catastrophic wildland fire, which would improve conditions for native plants and animals that provide traditional lifeway values, would also be similar under all the alternatives.

Under the No Action Alternative, the number of herbicides used by the BLM would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. Adding new herbicides would increase the total number of active ingredients released into the environment. From a perspective of potential risks to Native Americans from exposure to herbicides, the three new herbicides have no to low risk to humans via various exposure scenarios. The potential for synergistic human health effects associated with mixtures of multiple ingredients is not known.

Visual Resources

Past Effects and Their Accumulation

Past effects to visual resources, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-229 to 4-230). Humans have altered the visual character of lands in the western U.S. through activities such as resource extraction, agriculture, road construction, urbanization and other development, timber harvesting, livestock grazing, introduction of exotic species, and exclusion of fire. As a result, landscapes have changed, and are now marked by different vegetation composition, structure, and pattern.

Future Effects and Their Accumulation

Future effects to visual resources, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-225). The activities described in the preceding paragraph continue to influence the visual characteristics and scenic quality of landscapes. Ongoing vegetation management programs will alter the visual quality of public lands over the short term by removing vegetation, and in some cases creating large areas of open, browned, or blackened landscapes. However the BLM’s long-term goals to restore degraded lands, reinstate properly functioning ecosystem processes, and restore degraded lands will likely help improve the visual character of public lands, particularly for VRM Class I and II lands with high scenic values. Other federal, state, tribal, and local agencies, and private conservation groups will also continue efforts to improve land health which will result in countervailing effects to visual resources.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be similar under all of the alternatives, impacts to visual resources would occur over a similar geographic area under all alternatives. Additionally, the degree of the effects, and their contribution to cumulative effects, would be similar under all the alternatives. None of the alternatives would alter land uses on public lands, or introduce long-term changes that would be in conflict with the BLM’s visual resource management goals. Over the long term, all of the alternatives would be expected to contribute positively to scenic qualities of public lands. Additionally, all of the alternatives would help reduce the risk of wildfire that has a visual impact on public lands and other scenic lands in the western U.S.

Wilderness and Other Special Areas

Past Effects and Their Accumulation

Past effects to wilderness and other special areas, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-229 to 4-231). While wilderness and other special areas continue to be protected from development by their status designations, these areas are threatened by factors that degrade their unique qualities. These factors include: 1) exotic and non-native species; 2) wildland fire suppression; 3) loss of water and deterioration in water quality; 4) fragmentation and isolation of wilderness as ecological islands; 5) loss of threatened and endangered species; 6) deterioration in air quality; 7) motorized and mechanical equipment trespass and use; 8) increasing commercial and public recreation use; 9) adjacent land uses; and 10) urbanization and encroachment. All of these factors continue to contribute to loss of wilderness values or other unique qualities.

Future Effects and Their Accumulation

Future effects to wilderness and other special areas, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-231 to 4-232). The threats described in the previous paragraph are ongoing, and will continue to impact the unique qualities of wilderness and other special areas. With increases in population these areas may be further degraded through overuse. Additionally, pressure to utilize protected areas for resource extraction may result in future loss or degradation of these areas. Vegetation treatment programs in and near these areas that aim to control the spread of noxious weeds and restore natural fire regimes, if successful, will help reduce some of the threats to wilderness and other special areas, but not others. Actions by conservation groups and other entities to protect these areas may also help offset or slow some of the factors that degrade the unique qualities of wilderness and other special areas.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides, as well as the areas targeted for treatments, would be similar under all of the alternatives, the impacts to wilderness and other special areas would also be similar under all the alternatives. Adverse effects to these areas would generally be short-term effects associated with site closures and disturbances during herbicide treatments. Therefore, they would not be expected to contribute to long-term adverse effects. Countervailing effects associated with slowing future degradation of these areas or improving them through control of invasive species and restoration of native habitats and disturbance regimes would also be similar under all the alternatives.

The number of herbicides used, which would vary to some degree under the alternatives, would not be expected to have a substantial difference in how the action contributes to cumulative effects. The BLM would be able to control target species and reduce wildfire risk under all alternatives, although there would be a few additional options under the action alternatives. Under the No Action Alternative, the number of herbicides used by the BLM with the potential to impact wildlife would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. The use of new active ingredients could introduce new chemicals to areas that are relatively undisturbed. Although the new active ingredients have low risk to fish, wildlife, and other resources, the cumulative increase in pesticide use in wilderness and other special areas could have a negative connotation from a public opinion perspective.

Recreation

Past Effects and Their Accumulation

Past effects to recreation, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-223 to 4-233). Recreation opportunities on public lands have increased with the creation of recreational facilities and development of numerous recreation programs. These programs provide opportunities for outdoor recreation for millions of visitors annually. Other uses on BLM lands, such as livestock grazing, timber harvesting, and oil and gas activities, have limited recreation opportunities in certain locations. Additionally, the spread of invasive plants and wildfires have adversely affected recreation opportunities.

Future Effects and Their Accumulation

Future effects to visual resources, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-233 to 4-234). With the growth of the population in the West and a continued interest in recreation, the amount of use that BLM lands receive by the public will likely continue to increase. At the same time, the BLM will not be able to substantially expand its recreational opportunities. Therefore, existing lands and recreational facilities will be used more intensively, potentially reducing the recreation experience in certain areas and resulting in degradation of recreational facilities. Recreational visitors likely contribute to the spread of invasive species on public lands. Additionally, development and other activities in areas near public lands could lessen recreational experiences if they are visible from public lands.

Vegetation treatment programs by the BLM have a goal of restoring native plant communities, improving wildlife habitat quality, controlling the spread of invasive species, and reducing wildfire risk, and would help to offset some of the impacts caused by recreationists, as well as improve the quality of recreational opportunities on public lands.

Contribution of Alternatives to Cumulative Effects

The acreage of public lands treated with herbicides would be similar under all of the alternatives, and impacts to recreation would occur over a similar geographic area under all alternatives. Additionally, the degree of the effects, and their contribution to cumulative effect, would be similar under all the alternatives. Adverse effects associated with herbicide treatments would be short-term in duration, and would be unlikely to contribute to long-term adverse effects to recreation. Beneficial effects associated with control of invasive species, reduction of wildfire risk, and restoration of native plant communities would be similar under all of the alternatives.

Under the No Action Alternative, the number of herbicides used by the BLM would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. Under all alternatives, herbicides would be available that would allow the BLM to meet its treatment goals, including control of invasive species at visitor centers and other recreational facilities, restoration of native communities, and protection of recreation sites from risks associated with wildfire. The action alternatives would allow the BLM additional options for treating invasive species that could improve the effectiveness of treatment programs in certain circumstances. Additionally, aminopyralid and fluroxypyr would be mixed with other active ingredients to improve their effectiveness against certain target plants, and may help address resistance management issues at sites where invasive species are controlled repeatedly.

Social and Economic Values

Past Effects and Their Accumulation

Past effects to social and economic values, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-235 to 4-236). Social and economic factors that are important from the perspective of public lands include the continued population growth in the western U.S. (13.8 percent between 2000 and 2010; U.S. Department of Commerce Bureau of the Census 2011), environmental justice concerns associated with communities with high densities of Native Americans and other minority populations, the importance of jobs and industries associated with natural resources and resource extraction, increasing wildfire risks and associated risks to private property, and economic benefits from activities conducted on BLM lands, such as grazing, harvest of timber and other forest products, and oil, gas, and geothermal development.

Industries related to natural resources, such as agriculture and mining, are important sources of employment and represent nearly half of the nation’s agricultural services, forestry, and fishing jobs.

Future Effects and Their Accumulation

Future effects to social and economic values, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-236 to 4-238).

It is expected that populations in the western U.S. will continue to increase, and that use of BLM-administered lands by the public will also continue to increase. Population growth is cumulative, and actions on public lands and elsewhere will continue to affect greater numbers of people, including larger minority and low income populations. BLM lands will continue to provide a source of revenue for the federal government and local economies, with a possible low-level increase in those benefits through activities to improve the condition of rangelands and other public lands. Oil, gas, geothermal, and mineral resource extraction on public lands is expected to continue to be an important source of income into the future. Recreation is also likely to continue to be an important source of income, with vegetation treatments that improve the quality of public lands for recreation likely to benefit recreational opportunities.

It is expected that expenditures by the BLM will continue to range from about $1 billion to $1.15 billion, with budgets fluctuating from year to year. It is also expected that the BLM will continue to generate more revenue for the federal government than it spends. Oil and gas resources will likely continue to be the primary source of revenue, with timber sales, grazing, and recreation also important, although to a much lesser degree.

With population increases in the western U.S., it is expected that effects to private property from activities on public lands will be an increasing concern. However, efforts by the BLM, Forest Service, and other agencies to reduce wildfire risk may have an overall benefit to private property over the long term if incidence and severity of wildfire is reduced, particularly in the WUI.

Contribution of Alternatives to Cumulative Effects

All of the alternatives would reduce the costs of herbicide treatments, although it is expected that there would be no difference in the BLM's overall expenditures on vegetation treatments. Under Alternative B, the cost reduction could be between 1 and 2 percent, whereas the reduction would be less than 1 percent under Alternative B, and a fraction of 1 percent under Alternative D. Annual vegetation treatments costs, assuming all methods, would be similar under all the alternatives, amounting to an estimated $1.4 billion. Under all alternatives, short-term adverse impacts in terms of costs and long-term improvements in terms of resource benefits would be similar, although the cost to obtain the same degree of benefit could be slightly higher under Alternatives B and C because of lower herbicide costs. Under all alternatives, the contribution of treatment actions to the economy of the western U.S. would continue to be minor.

Human Health and Safety

Past Effects and Their Accumulation

Past effects to human health and safety, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-238 to 4-241). In terms of occupational risks, workers in the western U.S., including workers on public lands, have been exposed to risks associated with use of power tools, vehicles, loud noises, and other risk factors. Certain occupations may expose workers to chemicals (including pesticides) and other substances that can lead to cancer and other health conditions. Job-related fatalities and injuries continue to be reported in the western states. The public is also exposed to various chemicals and environmental pollutants, and may be at risk for injury or death as a result of fire, particularly in the WUI.

Future Effects and Their Accumulation

Future effects to human health, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-212 to 4-213). Many of the health and safety concerns discussed in the preceding paragraph will continue to be concerns in the future. Many occupations will continue to be associated with some level of risk, particularly when vehicles and machinery are operated, and when workers are exposed to potentially hazardous chemicals. Firefighters will continue to be exposed to high levels of risk. However, implementation of employer health and safety programs and associated steps to reduce risk will continue to help protect worker health and safety. Pesticide operators and other BLM workers will continue to transport and handle ingredients that pose a toxicological risk to humans, although these risks will continue to be minimized through SOPs and use of appropriate personal protective equipment.

The public will continue to be exposed to various pollutants; the cumulative effects of these exposures could include development of cancer and health conditions. Risks associated with wildfire, such as smoke inhalation risks and potential for loss of life, could increase if large, difficult to control wildfires continue to increase in frequency and size. Treatment programs by the BLM and other agencies to take aggressive actions to reduce catastrophic fire risk may continue to offset some of the wildfire risk in targeted areas, such as the WUI where the most people are likely to be affected.

Contribution of Alternatives to Cumulative Effects

Under all of the alternatives, a similar acreage would be treated with herbicides annually, with the same treatment goals, so the geographic extent of adverse and beneficial effects associated with herbicide use would also be similar. Under all of the alternatives, herbicides with some risk to human health would be applied in the same areas on public lands, although the number of herbicides used and the amounts of usage would vary among the alternatives. Under the action alternatives, two or three new active ingredients would be used, in addition to currently approved herbicides, resulting in a cumulative increase in the number of ingredients used on public lands. The new herbicides have no to very low risk to human health via various exposure scenarios. The potential for synergistic human health effects associated with mixtures of multiple ingredients is not known.

Benefits to human health from herbicide treatments would be similar under all the alternatives. Treatments would help reduce wildfire risk and associated risks to human health. Over the long term, restoration of natural fire regimes and improvement in ecosystem health should reduce risks to human health from activities originating on public lands and affecting public land users or those living near public lands.

Unavoidable Adverse Effects

The 2007 PEIS summarizes the unavoidable adverse effects that would occur as a result of the BLM's vegetation management programs, including herbicide treatments with the 18 currently approved herbicides and other forms of vegetation treatment analyzed in the 2007 PER (USDOI BLM 2007a:4-243 to 4-246).

As the three new herbicides would be incorporated into the BLM's treatment programs, but the extent and goals of those programs would remain unchanged, the analysis provided in the 2007 PEIS is largely applicable to treatments involving aminopyralid, fluroxypyr, and rimsulfuron. This information is summarized here.

Air Quality

Herbicide treatments would continue to result in the release of air quality pollutants, including GHGs. No new air emissions would occur as a result of adding the three new herbicides.

Soil Resources

Herbicide treatments would continue to result in increased erosion over the short term, and potentially loss of soil and soil function and productivity. No additional impacts to soil would occur as a result of adding the three new herbicides, although soil resources would be exposed to new active ingredients and their degradation products.

Water Resources and Quality

Herbicide treatments would continue to result in soil erosion and surface water runoff from removal of vegetation, and impacts to surface water and groundwater quality. The geographic extent of water resources potentially exposed to herbicide treatments would show little change as a result of adding the three new herbicides, but new active ingredients, degradates, and other ingredients would be released to the environment, increasing the number of potential water contaminants.

Wetland and Riparian Areas

Herbicide treatments in wetlands and riparian areas would continue to increase soil erosion and surface water runoff, potentially leading to streambank erosion and sedimentation into wetlands and riparian areas. Removal of vegetation could also alter wetland hydrology and function. The extent of these impacts would not change substantially from current levels as a result of adding the three new herbicides.

Vegetation

Herbicide treatments would continue to cause unavoidable short-term disturbances to plant communities by killing both target and non-target plants. The extent of these impacts is not expected to change substantially as a result of adding the three new herbicides, as they act by modes of action similar to those of some of the currently approved active ingredients.

Fish and Other Aquatic Organisms

Removal or alteration of vegetation in and near aquatic habitats would continue to affect fish and other aquatic organisms through release of sediments into habitats, or by changing other habitat characteristics (such as amount of shading). With the addition of the three new herbicides, the extent of these impacts would show little change.

Wildlife Resources

Some wildlife would be exposed to herbicides as a result of treatments and could suffer toxicological effects. Adding the three new herbicides would not substantially change the level of effects to wildlife, and could potentially decrease them, as the three new herbicides are of low risk to wildlife. Herbicide treatments would also continue to alter wildlife habitat, and could cause unavoidable short-term adverse effects to wildlife habitat and behavior. With the addition of the three new herbicides, the extent of these impacts would not change substantially.

Livestock

Herbicide treatments would continue to temporarily affect livestock by removing non-target vegetation used as forage or for other needs. Some exposure of livestock to herbicides could also occur, potentially resulting in toxicological effects. The three new herbicides do not pose a risk to livestock, and would not increase impacts to vegetation used by livestock over current levels.

Wild Horses and Burros

Herbicide treatments would continue to have the potential to impact wild horses and burros by removing non-target vegetation used as forage or for other needs. Some exposure of livestock to herbicides could also occur, potentially resulting in toxicological effects. The three new herbicides do not pose a risk to wild horses and burros, and would not increase impacts to vegetation used by these animals over current levels.

Paleontological and Cultural Resources

Paleontological Resources

Herbicide treatments would continue to have the potential to affect fossil resources through exposure of these resources or potential chemical alterations associated with active or other ingredients in herbicide formulations. The action to add three new herbicides would not increase the likelihood of risk to these resources unless one of the active ingredients is particularly damaging to fossil resources. Use of SOPs would reduce the likelihood of impacts to paleontological resources.

Cultural Resources and Traditional Lifeway Values

Herbicide treatments would continue to have the potential to affect cultural resources, primarily through chemical alterations of cultural materials associated with active or other ingredients in herbicide formulations. Use of herbicides would continue to have the risk of impacting non-target plant species of cultural importance to Native peoples. Herbicide treatments could also discourage or prohibit Native peoples from using these areas, or potentially harm Native peoples harvesting plant materials or conducting other activities in treated areas. However, the addition of three new active ingredients would not increase these unavoidable risks or impacts beyond current levels.

Visual Resources

Herbicide treatments would not result in unavoidable adverse effects to visual resources over the long term, but over the short term they could adversely affect the visual character of the treated areas. Adding the three new herbicides would not substantially change the extent or degree of effects to visual resources.

Wilderness and Other Special Areas

Herbicide treatments would continue to affect wilderness and other special areas through removal of vegetation, alteration of plant communities, and through human presence in wilderness areas. Adding the three new herbicides would not substantially change the extent or degree of these effects.

Recreation

Unavoidable adverse effects to recreation from herbicide treatments would continue to include scenic degradation and noise associated with treatments, alteration of resources, and the temporary closure of certain areas to recreation. Adding the three new herbicides would not substantially change the extent or degree of these effects.

Social and Economic Values

Short-term closures or restrictions on public lands, such as implementation of herbicide use re-entry restrictions to protect public health or to restrict access by grazing animals for the time period specified on the herbicide label until seeding efforts are established (up to two growing seasons), would continue to be unavoidable. Communities that are particularly dependent on a single industry would continue to be the most susceptible to adverse effects to employment or income due to vegetation treatment projects. In particular, ranching communities and recreation-dependent communities may be more affected than communities with diversified industries.

Limits on grazing activity on public lands could continue to put additional pressure on often tight economic margins in ranching. Closures of treatment areas for extended periods of time could temporarily affect some recreational uses and commercial activities. Adding the three new herbicides would not substantially change the extent or degree of these effects.

Human Health and Safety

Herbicide treatments would continue to have the risk of harming workers or the public, primarily through accidental exposures to herbicides. Although workers would follow all SOPs to reduce risks, not all risks could be avoided. The addition of three new active ingredients would not increase the degree of risks to human health and safety. The three new active ingredients have no to low risks to humans.

Relationship between the Local Short-term Uses and Maintenance and Enhancement of Long-term Productivity

This section discusses the short-term effects of herbicide treatment activities, versus the maintenance and enhancement of potential long-term productivity of public land environmental and social resources. The 2007 PEIS summarized this information for the BLM's ongoing vegetation management programs (USDOI BLM 2007a:4-246 to 4-251).

As the three new herbicides would be incorporated into the BLM's vegetation management programs, but the extent and goals of those programs would remain unchanged, the analysis provided in the 2007 PEIS is largely applicable to treatments involving aminopyralid, fluroxypyr, and rimsulfuron. This information is summarized here.

In all cases, short-term refers to the total duration of vegetation treatment activities (10 to 15 years) and long-term refers to an indefinite period of time.

Air Quality

Herbicide treatments would have a small short-term impact on air quality, predominantly associated with use of vehicles during applications. Much of the focus of treatments is on reducing hazardous fuels, restoring natural fire regimes and reducing the occurrence of large, unwanted wildfires. Thus, the proposed vegetation treatments should reduce smoke emissions associated with public lands over the long term. While individual herbicide treatment projects would have GHG emissions, repeated herbicide treatments and post-treatment reseeding/restoration may reduce the risk of wildfire, leading to fewer GHG emissions in the long term.

Soil Resources

Although treatments would have short-term effects on soil condition and productivity, it is predicted that the soil disturbance associated with restoration activities would have less impact and be less severe than soil erosion caused by wildfire and encroachment by invasive species and noxious weeds. Furthermore, monitoring and evaluation, integrated with an adaptive management approach, would allow the BLM to adjust treatments to reduce soil disturbance to levels similar to historical conditions.

Restoration activities that move forests and rangelands toward historical ranges of variability would provide favorable conditions for soil functions and processes, and contribute to long-term soil productivity levels at the broad scale (USDA Forest Service and USDOI BLM 2000).

Water Resources and Quality

Herbicide treatments would result in short-term impacts to water quality through movement of active and other ingredients into the water and through erosion and surface water runoff from treatment sites. Successful control of invasive plants, however, would lead to improved conditions in watersheds over the long term, with the greatest improvement likely to occur in degraded watersheds. Additionally, treatments that reduce hazardous fuels would benefit ecosystems by reducing the chances of a large, unwanted wildfire, which could result in the destruction of a large amount of high quality habitat, potentially leading to erosion, especially if followed by heavy rainfall. Hazardous fuels reduction would also decrease the likelihood that wildfire suppression activities would occur in or near aquatic habitats.

Wetland and Riparian Areas

Removal of vegetation could cause a short-term increase in soil erosion and surface water runoff and could impact wetland and riparian areas. Additionally, there could be some release of active and other ingredients into wetland and riparian areas. Successful control of invasive plants in wetlands and riparian areas, however, would lead to improved conditions in these habitats over the long term. The eventual growth of desirable vegetation in treated areas would moderate water temperatures, buffer the input of sediment and herbicides from runoff, and promote bank stability in riparian areas.

Vegetation

Herbicide treatments would remove vegetation from treatment sites over the short term, and could impact non-target desirable vegetation. However, treatments that remove or control invasive vegetation would benefit non-target species by providing increased access to water and nutrients and enhanced vigor from reduced competition with invasive species. Over the long term, target sites should have an increased component of native species. Additionally, control of cheatgrass and other fire adapted species would benefit the long-term health of plant communities in which natural fire cycles have been altered. Over the long term, treatments should also reduce the occurrence of large, unwanted wildfires across the western U.S.

Fish and Other Aquatic Organisms

Herbicide treatments could have short-term adverse impacts to fish and other aquatic organisms through release or movement of active and other ingredients into aquatic habitats. These impacts would be minimized through the use of buffers. The three new herbicides are of low risk to aquatic species. Over the long term, control of noxious weeds in riparian habitats, reduction of wildfire risk through hazardous fuels reduction, and other efforts to improve the quality of watersheds would have beneficial effects on fish and other aquatic organisms. Benefits would include improved habitat quality, improved hydrologic functions, and reduced soil erosion.

Wildlife Resources

All treatments could have short-term adverse impacts to wildlife and wildlife habitat, as discussed under Unavoidable Adverse Effects above. The three new herbicides are of lower risk to wildlife than many of the currently approved herbicides. Treatments that improve habitat would provide long-term benefits to wildlife by restoring wildlife habitat and reducing the risk of catastrophic wildfire. Habitat improvements would likely be slow, occurring over multiple decades.

Livestock

The proposed vegetation treatments would affect the availability and palatability of livestock forage over the short term. These impacts would begin to disappear within one to two growing seasons after treatment. Over the long term, the quality of forage should improve, as noxious weeds that are unpalatable or toxic to wildlife would be controlled. Additionally, reduction in the risk of future catastrophic wildfire would benefit livestock by preventing the temporary loss of large blocks of rangeland to fire, and reducing the prevalence of fire-adapted species.

Wild Horses and Burros

The proposed vegetation treatments would affect the availability and palatability of vegetation over the short term. These impacts would begin to disappear within one to two growing seasons after treatment. Over the long term, the quality of forage should improve, as noxious weeds that are unpalatable or toxic to wild horses and burros would be controlled. Additionally, reduction in the risk of future catastrophic wildfire would benefit wild horses and burros by preventing the temporary loss of large blocks of habitat that would displace wild horses and burros and potentially reduce the AML.

Paleontological and Cultural Resources

Paleontological Resources

Because paleontological resources are nonrenewable, there is no difference between short-term and long-term impacts. These resources cannot recover from some types of adverse impacts. Once disturbed, the materials and information of paleontological deposits may be permanently compromised. Chemical alterations to fossil materials would likely be permanent. Any destruction of paleontological sites, especially those determined to have particular scientific value, would represent long-term losses. Furthermore, once paleontological deposits are disturbed and exposed, natural erosion could accelerate the destruction of fossils, and exposed fossils would be vulnerable to unauthorized collecting and digging. Any discoveries of paleontological resources as a result of surveys required prior to treatment would enhance long-term knowledge of the area and these resources.

Cultural Resources and Traditional Lifeway Values

Any destruction of cultural resource sites would represent long-term losses. Chemical alterations to historic materials would likely be permanent. Archaeological excavation to recover scientific data under the terms of an appropriate data recovery plan could result in the partial or total destruction of the site, although the recovered data would effectively mitigate for this destruction. Any investigations of cultural resources made during inventories or investigations required prior to herbicide treatments would enhance knowledge of the history and early inhabitants of the region and serve to effectively mitigate further potential effects of activities in the area.

Herbicide treatments could have short-term impacts on traditional lifeway values by temporarily restricting access to traditional use sites, and by impacting non-target vegetation of cultural importance. Herbicide treatments could also temporarily displace wildlife used for subsistence. However, long-term restoration of native plant communities and natural ecosystem processes to the benefit of traditional lifeway resources should compensate for the short-term losses in use.

Visual Resources

Vegetation treatments would continue to affect visual resources by changing the scenic quality of the landscape. Over the short term, impacts to visual resources from herbicide treatments would begin to disappear within one to two growing seasons. The regrowth of vegetation on the site would eliminate much of the stark appearance of treated areas, and the site would develop a more natural appearance.

Over the long term, vegetation treatments would likely improve visual resources on public lands. Treatments that aim to rehabilitate degraded ecosystems, if successful, would result in plant communities dominated by native species (see the Vegetation section for more information). Native-dominated communities tend to be more visually appealing and productive than areas that have been overtaken by weeds (e.g., areas supporting a cheatgrass monoculture).

Wilderness and Other Special Areas

Impacts to wilderness and other special areas would begin to disappear within one to two growing seasons after herbicide treatments. The regrowth of vegetation on the site would eliminate much of the stark appearance of treated areas, and the site would develop a more natural appearance. Benefits to plants and animals in terms of ecosystem function and improved forage and cover would occur as the treated area recovered.

Over the long term, vegetation treatments would likely improve resources in wilderness and other special areas. Treatments that successfully rehabilitate degraded ecosystems would result in plant communities that are dominated by native species (see the Vegetation section for more information). Native-dominated communities often provide better habitat for fish and wildlife, including species of concern, that occur in communities with a large component of non-native species.

Recreation

There would be some scenic degradation, as well as distractions to users (e.g., noise from vehicles), from treatments. In addition, there would be some human health risks to recreationists associated with exposure to herbicides, which would be minimized through use of SOPs. Finally, some areas would be off-limits to recreation activities as a result of treatments. These effects would be localized and short-term.

Treatments that restore native vegetation and natural fire regimes and other ecosystem processes would provide a long-term benefit to recreationists. Treatments would improve the aesthetic and visual qualities of recreation areas, reduce the risk of recreationists coming into contact with noxious weeds and poisonous plants, increase the abundance and quality of plants harvested from public lands, and improve habitat for fish and wildlife sought by fishermen and hunters.

Social and Economic Values

Over the short term, restrictions on the use of treated lands could cause social and economic hardship to affected parties. However, individuals and industries involved in the restoration of native ecosystems on public lands would benefit.

Over the long term, most users of public lands, and those with interests near public lands, would likely benefit. An important goal of treatments is to restore ecosystem health so that public lands can provide sustainable and predictable products and services. In addition, treatments would reduce risks to communities associated with large-scale wildfire, improve ecosystem health to the benefit of recreationists and other public land users, and emphasize employment- and income-producing management activities near those communities most in need of economic support and stimulus. The enhancement in long-term productivity of public lands to provide for social and economic needs would reflect not only the success or failure of treatments, but also the influence of outside forces (e.g., economy, lifestyle changes, and climate) over which the BLM and other federal agencies have no control (USDA Forest Service and USDOI BLM 2000).

Human Health and Safety

Herbicide treatments could harm the health of workers and the public over the short term, although SOPs would minimize these risks. The three new herbicides have no to low health risks under most exposure scenarios. Adverse reactions to herbicides could cause minor to severe discomfort to sensitive individuals, but most symptoms would go away in a few hours. If serious injury or death were to result from treatments (most likely to occur as a result of vehicle operation), the effects to the health of the affected individual would be long-term, or in the case of death, permanent.

All treatments that successfully reduce the cover of noxious weeds and restore native vegetation would help to restore natural fire regimes and improve ecosystem health, which would in turn provide a benefit to human health. A reduced risk of wildfire would reduce the risk of injury, death, and other health risks associated with fire. Additionally, herbicide treatments would slow the spread of poisonous and other noxious weeds that are harmful or annoying to humans.

Irreversible and Irretrievable Commitment of Resources

This section identifies irreversible and irretrievable commitments of resources that would occur from herbicide treatments. Irreversible and irretrievable commitments of resources refer to impacts or losses to resources that cannot be reversed or recovered. Examples are the extinction of a species or the permanent conversion of a vegetated wetland to open water. In the first case, the loss is permanent and not reversible under current genetic technology. In the second case, it is possible the open water could be drained, so while the initial loss of the vegetated wetland is irretrievable, the action could be reversible.

Since aminopyralid, fluroxypyr, and rimsulfuron would be utilized in existing treatment programs and are generally of low risk to resources, their addition to the list of approved active ingredients would not result in additional irreversible or irretrievable commitments of resources above what was discussed in the 2007 PEIS (USDOI BLM 2007a:4-251 to 4-253). Commitments pertaining to herbicide treatments from this earlier document are summarized here.

Air Quality

Air quality would be affected by emissions from vehicles used during herbicide applications. These effects would occur only during the period of the treatment activity and there would be no irreversible or irretrievable effects on air quality.

Soil Resources

Herbicides could impact soil biota and productivity, although it is unclear to what degree these effects would be irreversible or irretrievable. It is expected that soil functions would eventually return with the establishment of native vegetation and a reduced risk of wildfire.

Water Resources and Quality

An accidental herbicide spill could cause damage to water bodies lasting for several months. The ability to use water resources in the affected area could be lost for an unknown period of time. In many cases, these impacts could be reversed over time through degradation of the active and other ingredients and their degradates. In other cases, irreversible or irretrievable commitments of water resources could occur.

Wetland and Riparian Areas

Although there would be short-term impacts to these resources from herbicide treatments, these impacts generally would not be irretrievable and would be reversed with degradation of the herbicides and if restoration treatments were successful. Under certain circumstances, irreversible or irretrievable commitments of wetland or riparian resources could occur.

Vegetation

Native vegetation and plant productivity that is lost as a result of treatments would be irretrievable only until vegetation is reestablished, usually within several growing seasons. Some individual plants would be affected irreversibly. However, with the use of appropriate buffers to protect populations, irreversible and irretrievable loss of special status plants would not occur.

Fish and Other Aquatic Organisms

Special status aquatic invertebrates would be at risk for adverse toxicological effects from herbicide treatments with fluroxypyr under accidental spill scenarios. Buffer zones to protect aquatic species would minimize these risks. While some individual organisms could be affected irreversibly by alterations to habitat, overall effects to populations would be reversible. Additionally, populations would benefit from treatments that improve riparian and aquatic habitats.

Wildlife Resources

While none of the three new herbicides pose a toxicological risk to wildlife, some individual organisms could be affected irreversibly by equipment used during treatments or habitat modification. However, overall effects to populations would be reversible. Native wildlife and habitat productivity that is lost as a result of treatments would be irretrievable until native plant communities are reestablished, usually within several growing seasons. Treatments that improve rangeland and forestland ecosystem health, including plant productivity, would translate into benefits for wildlife, except for those species that have adapted to or thrive in areas where vegetation has changed from historic conditions.

Livestock

Short-term loss in vegetation function and quality from treatments would have a short-term impact on livestock productivity. Although some livestock could be displaced from public lands, forage could be found elsewhere, although possibly at a higher cost. As rangelands improve as a result of treatments, their ability to support livestock use levels at or near current levels should also improve. Herbicide treatments have the potential to cause toxicological impacts to livestock, although the three new herbicides are of low toxicity to large grazing mammals. Any impacts to the livestock operation and industry would be reversible.

Wild Horses and Burros

Short-term loss in vegetation function and quality as a result of herbicide treatments would have a short-term impact on wild horse and burro productivity. Wild horses and burros could be removed from rangelands to reduce their impacts to rangeland health and to speed up the process of rangeland restoration. These animals would be placed into adoption or long-term pastures, or sold. As rangelands improve, their ability to support populations of wild horses and burros near current levels would also improve.

Herbicide treatments have the potential to cause toxicological impacts to wild horses and burros, although the three new herbicides are of low toxicity to large grazing mammals. Any associated impacts to wild horse and burro populations would be reversible.

Paleontological and Cultural Resources

Paleontological Resources

Because paleontological resources are nonrenewable, any impacts would render the resource disturbance irreversible and the integrity of the resource irretrievable.

Cultural Resources and Traditional Lifeway Values

Cultural resources are nonrenewable, so any impacts would be irreversible, and the integrity of the affected resource would be irretrievable. Any chemical changes to cultural materials associated with herbicide exposure would potentially be permanent. Archaeological excavation to recover scientific data under terms of an appropriate data recovery plan could result in the partial or total destruction of the site, although the recovered data would effectively mitigate for this destruction. Any investigations of cultural resources made during inventories or investigations required prior to vegetation treatments would enhance knowledge of the history and early inhabitants of the region and serve to effectively mitigate further potential effects of activities in the area. Overall, such finds could help fill gaps in our knowledge of the history and early inhabitants of the area.

Vegetation treatment activities would impact plants and animals of traditional importance to Native peoples. However, these effects should be short-term and reversible, as native plant communities would recover and habitat for fish and game species would improve.

Visual Resources

There would be no irreversible or irretrievable commitment of visual resources. Although there would be short-term impacts to visual resources from vegetation treatments, loss of visual resources would not be irretrievable and could be reversed if restoration treatments are successful.

Wilderness and Other Special Areas

There would be no irreversible or irretrievable commitment of resources. Although there would be short-term impacts to wilderness and special area resources from vegetation treatments, these impacts would not be irretrievable and could be reversed if restoration treatments are successful.

Recreation

There would be no irreversible or irretrievable commitment of recreation resources. Although there would be short-term impacts to recreation resources from vegetation treatments, these impacts would not be irretrievable and could be reversed if restoration treatments are successful.

Social and Economic Values

Herbicide treatments would continue to involve a substantial commitment by the BLM in terms of labor and financial resources. Herbicide treatments associated with restoration activities would continue to provide temporary jobs in the western U.S. Once financial resources are used, they cannot be retrieved. Treatments that result in the closure of recreation or grazing areas could have an irretrievable impact on the income of those involved in these industries.

Human Health and Safety

Serious injury or death to humans caused by herbicide treatments could be irreversible and irretrievable. Risk of death or serious injury is very low, based on low numbers of past incidents, but accidents do occur. It is possible that humans would experience minor discomfort from herbicide treatments, but provided appropriate safety SOPs are implemented, these effects would be short-term and reversible.

Energy Requirements and Conservation Potential

Herbicide formulations may contain petroleum products, and all herbicide treatment methods require the use of energy, to operate equipment to treat vegetation and to transport workers to and from the job site. Less energy would be used to conduct aerial treatments than ground treatments for each acre treated. Because all of the alternatives treat the same land area using herbicides, energy use for all, including the No Action Alternative, would be similar.

Natural or Depletable Resource Requirements and Conservation

Herbicide formulations may contain natural or depletable resources as constituents of the herbicide products or as carriers. It is anticipated that the use of natural and depletable resources would be minimal, and would be roughly the same under all of the alternatives, as the acreage treated would be similar. All herbicide treatment methods require the use of energy, as described in the preceding section.